THE GLASS INDUSTRY

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BUSINESS AS USUAL— WHILE HARDING BUILDS A NEW BATCH PLANT

By HENRY E. WALKER

Harding Glass Company, Fort Smith, Arkansas

History

When the first production unit of the Harding Glass Company, a division of Fourco Glass Company, Clarksburg, West Virginia, was built in 1917, the all important glass batch was weighed on old-fashioned platform scales in wheelbarrows, then dumped on a brick floor and turned with shovels for mixing. In the early twenties a No. 12 Smith mixer was installed to do the mixing, still assembling and weighing by hand.

Materials were unloaded from box cars with wheelbarrows and dumped into bins partitioned off in a wood frame building. The bins fronted on a common hallway (Fig. 1) where materials were assembled and weighed. In 1936 an unloading system was installed consisting of a power shovel, conveyor belt, elevator, and a distributor head with pipes leading to the several material bins (See Fig. 2). This revolutionized the unloading system —rapid unloading at less cost, fewer man-hours exposure to dust, fewer openings in buildings, no waste, etc.

By 1942, with full production we had three mixers, two of which operated around the clock with the third as a standby because the demand was too great to permit idle mixing time.

The need for improved batch mixing facilities had been apparent to officials of the Harding Glass Company for several years. In 1946, we were authorized to proceed with plans for a new batch plant. Along with other data and information, our engineers visited most of the glass batch plants that had been built or modernized within the past several years to study the features in each of them that would seem most applicable to our needs. These visits, and discussions with the personnel operating the plants, were most valuable to us.

Choosing the proper location for a new batch plant required much consideration. First, the over-all plant layout for future requirements had to be brought up to date, anticipating expansion in production, cutting, warehousing, and other facilities, along with probable changes in operation which would require the ultimate in flexibility.

The fact that the batch plant must be constructed and put in service without disturbing the general plant operation complicated the planning and engineering, as well as the actual construction.

The location selected for the new batch plant was on the east side of the spur track between the furnace buildings, this being convenient for all batch material unloading, cullet return and storage, and delivery of batch to the furnaces. The spot chosen was occupied by the box shop. Therefore, we had to build a temporary box shop and move into it before the ground could be cleared for the batch plant.

Additional right of way for a second spur track paralleling the present one was provided for by cutting away portions of the buildings along the west side of the spur.

Plans

We chose to build a compact system for ease of operation, and to fit the space available for the new plant to a better advantage. A gravity flow system was considered at first but was rejected because of extra height required, plus a lack of data on gravity flow characteristics for certain of the batch materials and the lack of fine control that could be exercised over the gravity flow system.

A completely automatic system was decided upon with modifications to permit hand operation when necessary, and until the delivery system from batch plant to furnaces could be completed.

In order to secure the maximum in accuracy and also keep the height of the building to a minimum, vibrating feeders were used to control the flow of all materials from the storage bins to the scales and from the scales to the gathering conveyor. We planned to use the present batch cans and tie the Louden monorail system into the first floor of the batch plant so the new batch could be used on all units immediately upon completion. (At a later date, when furnaces are cold, the automatic batch cars will be installed for delivery of batch to the furnaces.)

Fig. 1. Weighing and mixing room in old batch plant, 1936-1949.

The plans and specifications were drawn by Chalmers & Borton Company of Hutchinson, Kansas, in conjunction with Bassham and Wheeler of Fort Smith, and our own engineering staff. Chalmers and Borton Company were contractors for the entire job.

Silos and Storage

Final plans were for a cluster of four round silos, two joining each other at each end of a rectangle located with its center line parallel to the railroad tracks. Several additional bins were built as cells between the two pairs of round bins. Two of these cells or bins were subdivided to form two additional units of storage space, but doors were left in the partition wall near the bottom so they could be used as single bins until such time as additional storage units are required, when they will be closed. Two material elevator shafts were built into the structure along with the main lift elevator shaft, venting flues, etc. See Fig. C-2, which is the draw form plan for the building.

The building's basement accommodates the material assembly belt, scale discharge feeders, three elevator boots, and connects directly to the two tunnels leading to the under track hoppers where the materials are unloaded. The basement floor is a 24"-thick concrete slab that rests upon the concrete pilings, which were pre-cast and driven to bedrock under the storage bin section of the building.

On the main floor are the scales (Fig. 3) and scale hoppers, scale feeders (Figs. 4 and 4-A) and their controls, and the control panel for the entire system (Fig. 5). The ceiling above this floor is the floor of the material storage bins (See Fig. M-5).

The roof of the material storage bins forms the floor of the head house which contains the turn head selector spout and four rigid chutes leading from the north material elevator to the two sand and two cullet bins. The swivel selector spout (Fig. 6) from the other material elevator reaches all the bins. With sand and cullet as the bulk of the materials required, one elevator is devoted to them alone. Actually, scrap cullet goes into the bin often enough to require that sand be unloaded on the

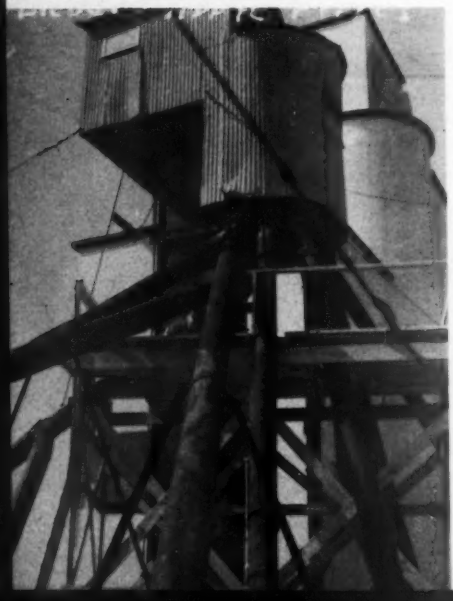


Fig. 2. (Left) Elevator shaft, turnhead selector spout, and pipes leading to the several material bins, installed in 1936 and used until 1949, are shown in foreground with new batch plant in background.

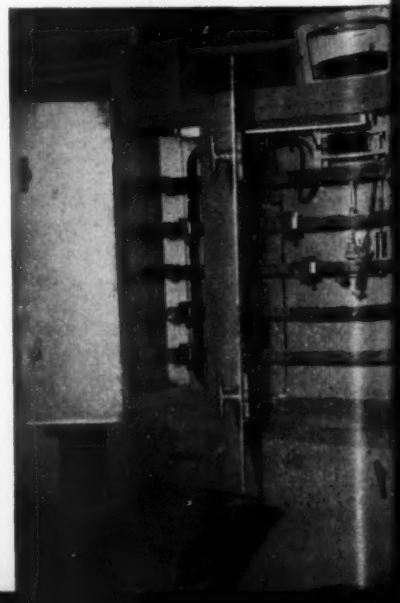


Fig. 3. (Right) Scale cabinet, furnished by Buffalo Scale Company, is typical of the scales and cabinets used throughout the plant. The small ingredient hopper is shown in foreground and is manually fed at present. The discharge feeder on it is interlocked with the system.

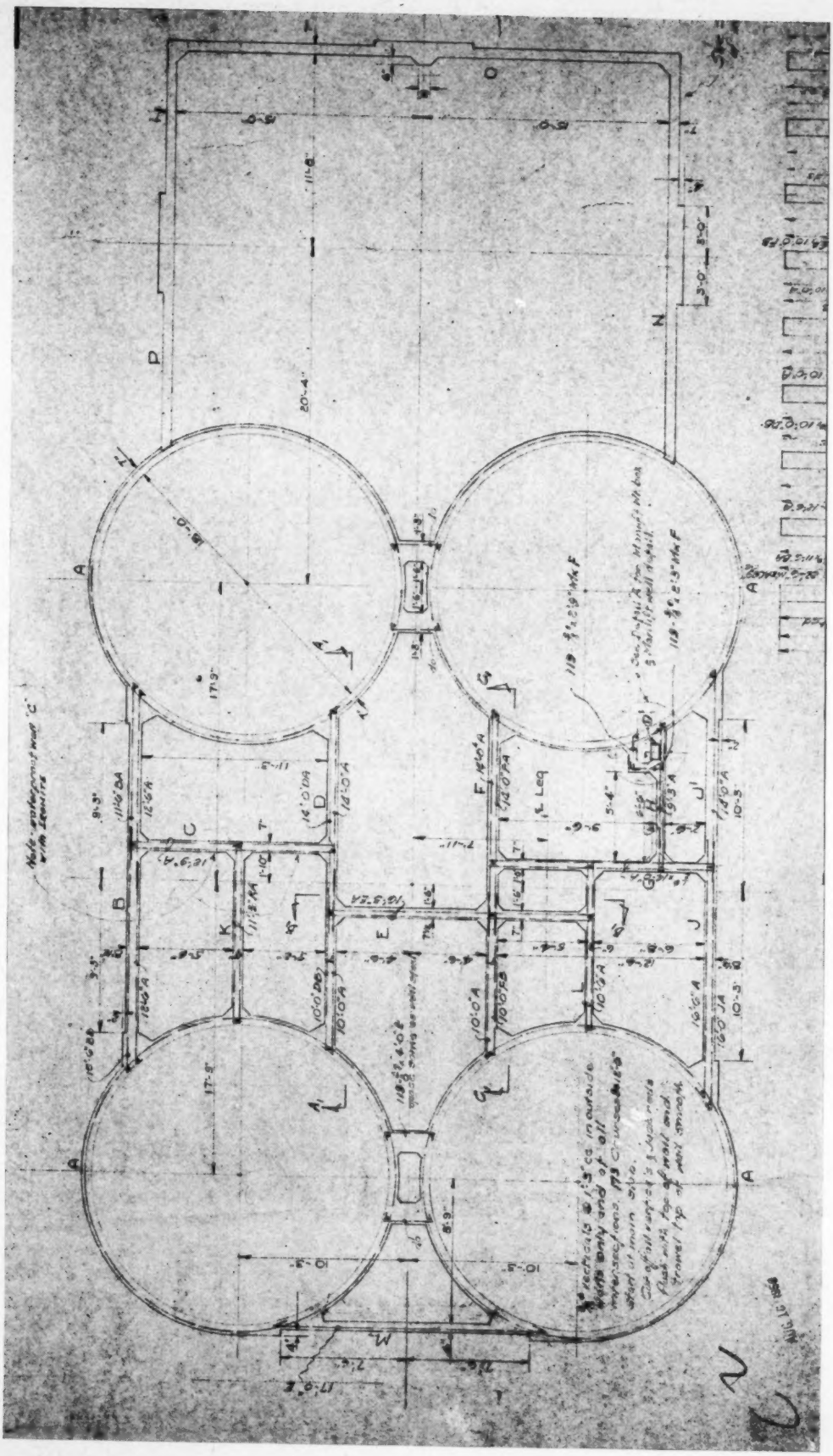


Fig. C-2.

SODA ASH
SODA ASH
SALT CAKE
DOLOMITE
FELDSPAR
CALCIUM
SAND
SAND
OVERHEAD BIN BOTTOMS

Fig. M-5.

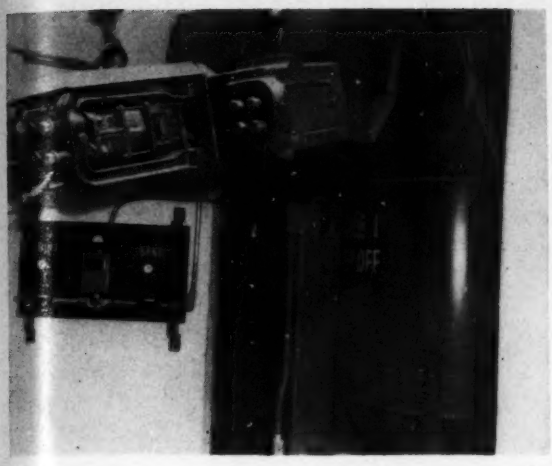


Fig. 4 and 4A. The materials are fed from the bins to scales with Jeffrey-Traylor vibrating feeders.

other elevator from time to time. The material elevators have a working capacity of 150 tons per hour of sand.

The unloading track sinks are covered with a track shed joined to the silos on one side and supported on the opposite side by steel columns. The roof is a concrete slab with a built-up felt and mastic wearing surface. The side wall is corrugated asbestos material (Fig. 7).

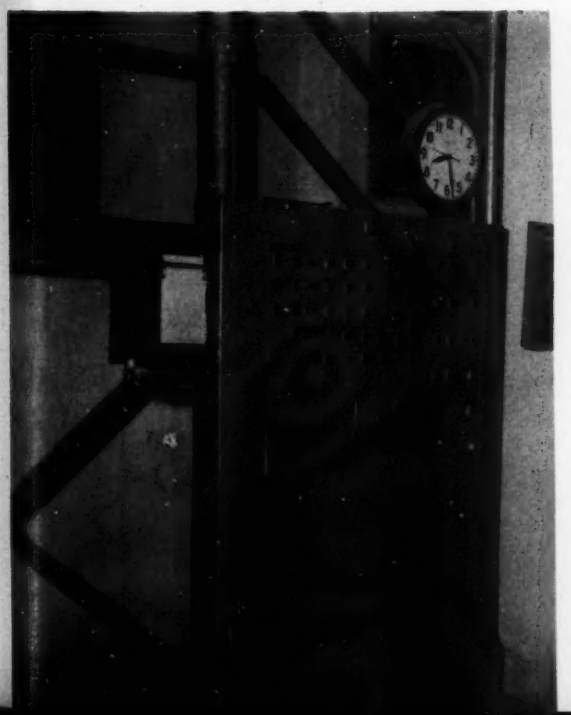
Four railroad cars can be spotted at one time for unloading. A fifty-ton hopper car of sand can be unloaded in less than thirty minutes. This leaves the track sinks free for receiving cullet when required. The cullet bins at the furnaces are equipped with crushers that crush the cullet before it is emptied into dump trucks which dump into the track sinks.

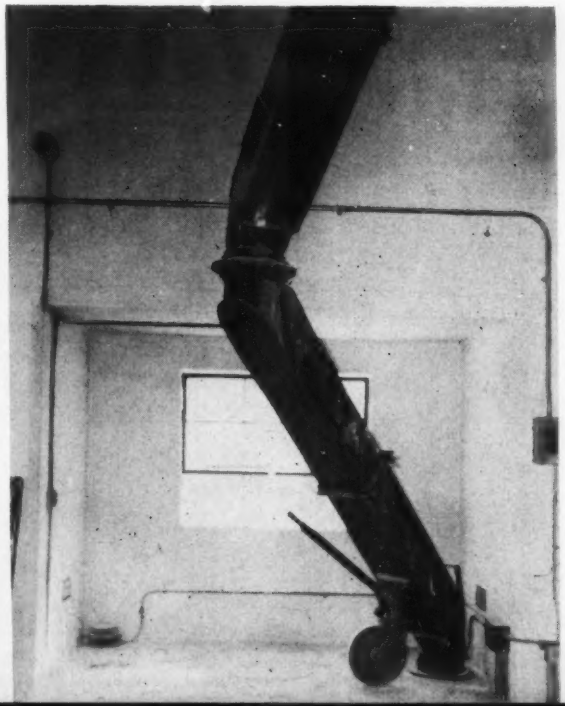
Mixing Building

The mixing building joins the silos on the south and is poured on a mat footing. It has a flexible construction joint at all points touching the silos.

The basement is at scale floor level of the silos and contains the electric distribution panels, freight elevator landing and storage area. The first floor of the mixing building now has the batch bucket monorails and batch discharge spouts, wash room and toilet facilities, and is at car door level for unloading package materials, etc. The second floor is used for storage only now, but has all openings and connections to accommodate the skip cars that will eventually be used to deliver batch to the plants. The third floor is the mixing floor, having two

Fig. 5. (Left) The control cabinet located on the scale floor is the central operating point. The "Esterline Angus" 20-point recorder mounted on the upper left side of the cabinet records every phase of the operation, plotting each batch as it is weighed, assembled, mixed, and discharged. This recording arrangement was worked out by our engineering department. Fig. 6. (Right) This manually operated swivel type selector spout delivers material to any bin.





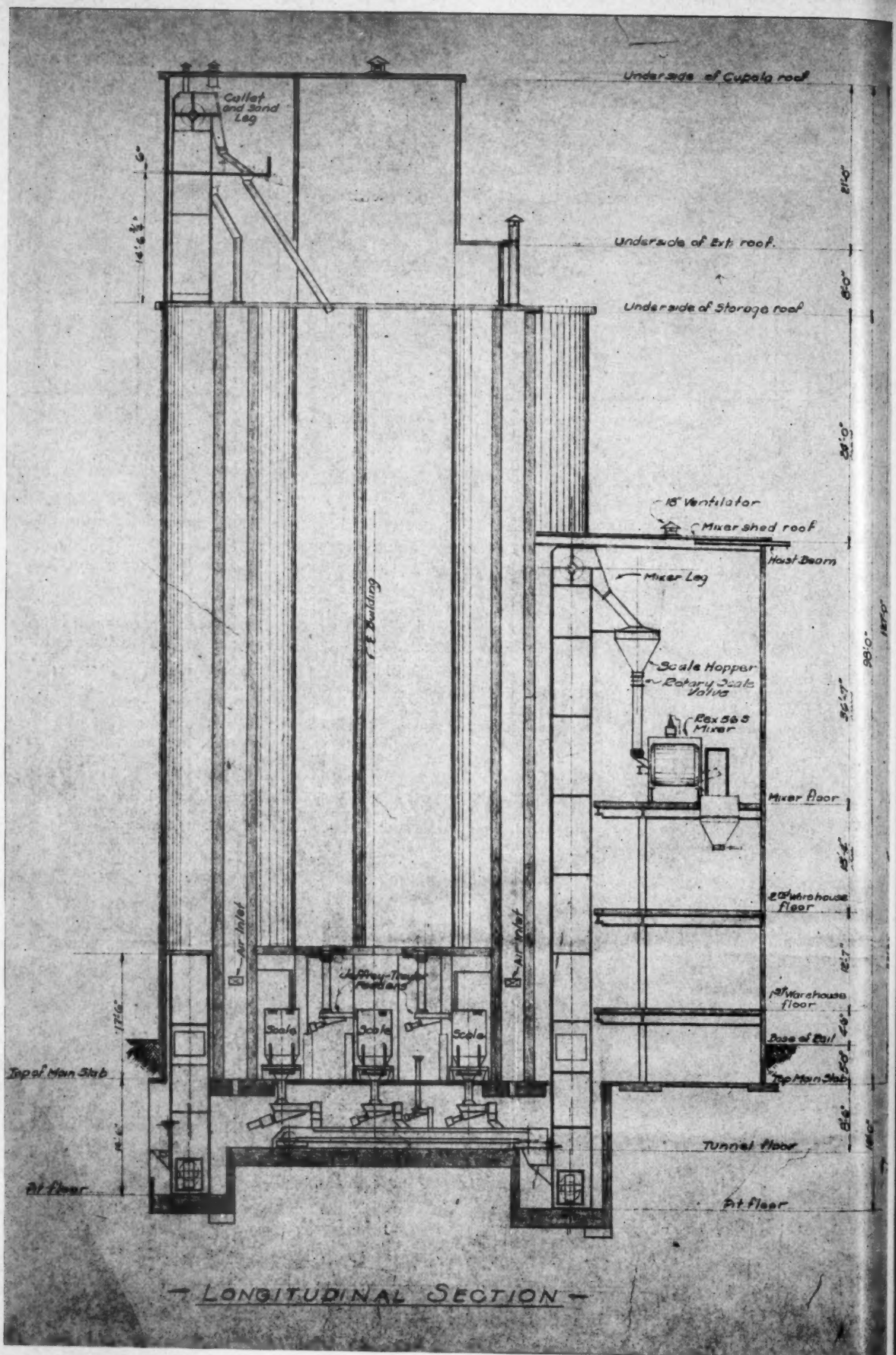


Fig. G-3. A longitudinal section showing order of flow for batch materials from silos through vibrating feeders to scales through a second vibrating feeder to an assembly belt which discharges into the boot of an elevator which discharges into a hopper scale above the mixer where the total batch is check-weighed before being discharged to the mixer.

"Rex" 56S mixers (Fig. 8), either one of which can mix for full production. One is maintained as a stand-by at all times. The surge bin and check weigh scales are located above the mixer and by selector gate can discharge into either mixer or into a truck or railroad car. The roof of the mixing building is the platform for the electric transformer station.

A beam hangs over the roof of this building for hoisting machinery and equipment. The third floor has a removable machinery window through which any piece of machinery can be moved. In fact, both mixers were received through this window.

Slip Form Construction

After the piling had been driven and the main slab and tunnels had been poured, the slip, or draw forms, were built on the slab to the exact shape and size of all the bins and flues, including the mixing building. The form was only four feet high and the lining was a good grade of pine flooring material nailed vertically for ease of slipping (Fig. 9).

To begin with, the bin partitions were blocked off flush with the outside wall line until the form was drawn and poured up to the level of the bin bottoms, at which time the blocking was removed and the bin bottoms poured. From that point the bin partitions were poured too, along with the outside walls, making a monolithic structure.

As window or door openings were approached, frames were dropped into the form and properly set and the form slipped up past them, leaving the frame in its proper position. At the roof line of the mixer building, the form for it was detached from the silo forms and they continued up to the roof of the silos. After the roof was poured on the silos, another slip form was constructed on top of the roof to pour the head house.

The concrete was poured continuously twenty-four hours per day and the forms were raised at the rate governed by the concrete setting, which was about as fast as the forms could be moved.

The forms were raised by means of screw type jacks

Fig. 7. West and south elevations of new batch plant showing track shed on west side. The large machinery window on the west side of penthouse is used for receiving machinery as is the one on the south side of the mixer building lower down.

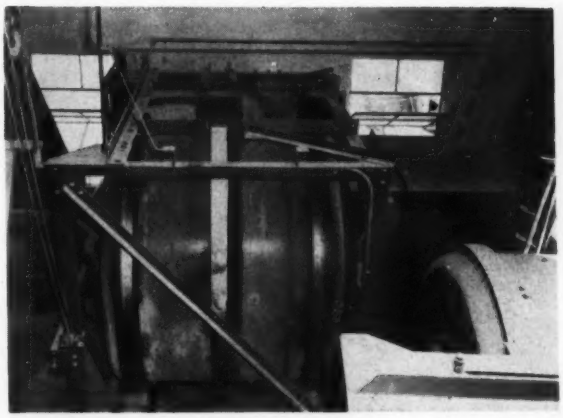
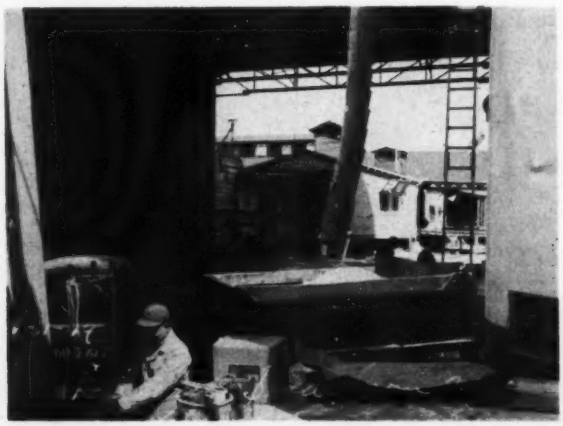


Fig. 8. The "Rex" 56S mixer does the mixing from both plants and its twin shown in the right foreground stands by at all times for an emergency.

Fig. 9. (Below) The draw forms are built on top of the main slab. Blands are placed in the forms to allow for various openings and floor connections as the forms are draw up vertically.

Fig. 10. (Right, below) A truck receiving batch material being discharged from new batch plant. Any material bin can be unloaded into a truck or railroad car.



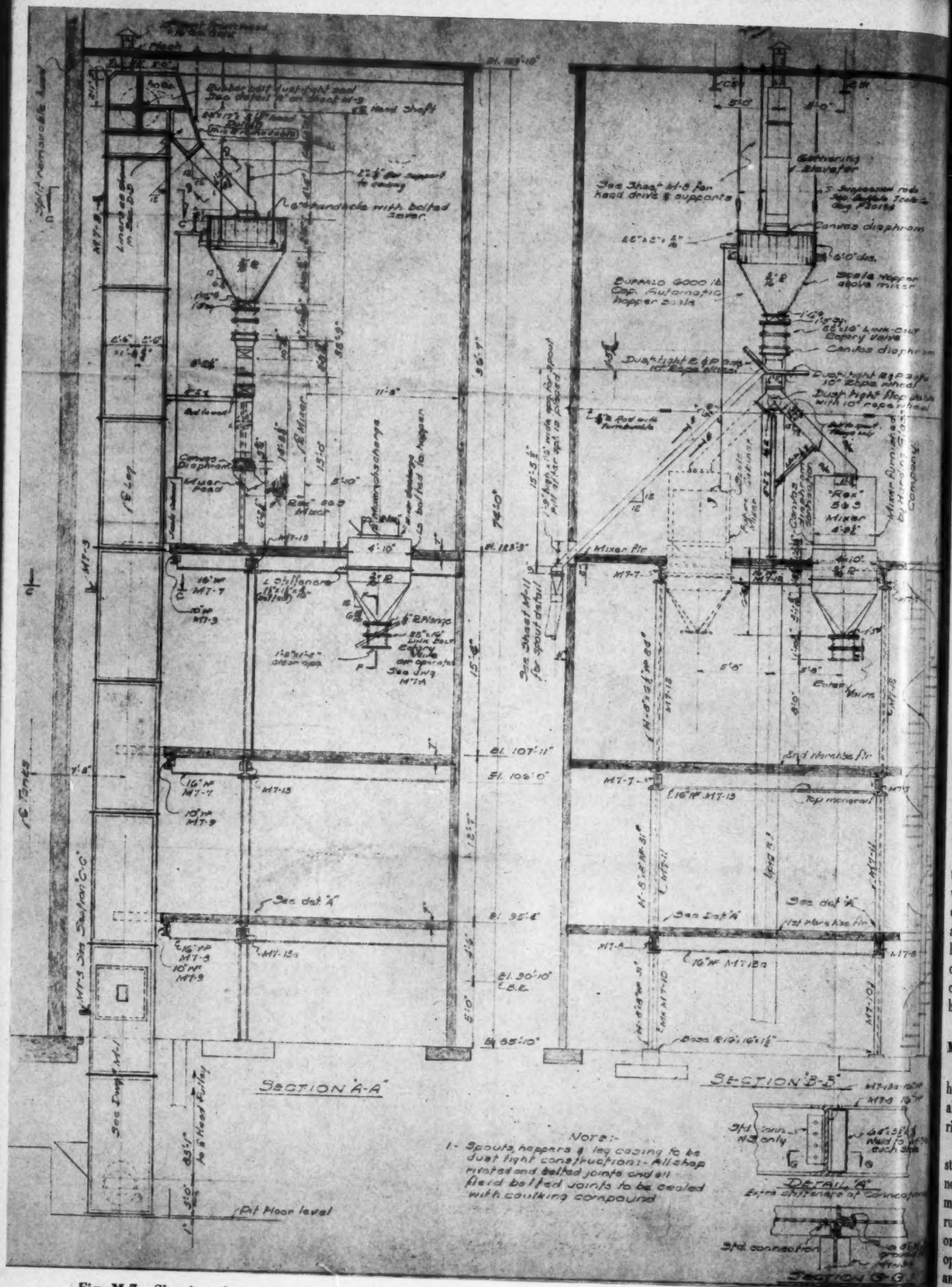

SECTION A-A
SECTION B-B
Note:-
1- Spouts, hoppers & leg casing to be dust tight construction - All shop riveted and bolted joints and all field bolted joints to be sealed with caulking compound
Pit floor level
Mixer Pit
Rex 503 Mixer
Buffalo 6000 lb. Cap. Automatic hopper scale
Gathering Elevator
Canvas diaphragm
Dust tight flap gate
Dust tight flap valve with 10" rope wheel
Scale hopper above mixer
Rubber belt dust tight seal
Head Shaft
Mixer Head
Mixer Pit
End Manhole Pit
Top mineral
Detail "A"
Section C-C

Fig. M-7. Showing the arrangement of the surge scales and hopper, batch mixers, and the discharge spout leading to railroad cars or trucks outside the mixing building.

attached to the vertical reinforcing rods in the concrete. Collars were attached to the form at all intersections and at the proper points between to support the weight. The draw form supported the finishing scaffolds, hoists, steel rod supply, and all the equipment required for pouring and finishing the concrete.

Upon completing the concrete work, the building was damp-proofed from basement to two feet above grade and the balance of the ouside painted with a white cement paint.

Operation

Materials are received in dump bottom cars and discharged to either sink. Box cars are unloaded with a single power shovel on track nearest building, at each track sink.

The valves on track sinks are operated from the unloading dock and discharge onto a belt conveyor. This conveyor discharges to the material leg, then to the top of the house where it is discharged to the various bins by a universal spout. Arrangements have been made to lock this spout to proper bins and lights at the bottom show position of the spout. The starter for the leg motor is located at the top and it can only be started from the top. It can be stopped from either top or bottom.

A second track sink is located approximately fifty (50) feet from the sink mentioned above. This also has facilities for receiving cullet from trucks. A belt conveyor carries from this sink to another conveyor running at right angles and it carries to the cullet leg. The cullet leg runs to the top of the house and discharges to the two sand bins and two cullet bins.

R&P gates are located on the bottom of all bins and spouts to Jeffrey vibrating feeders. These feeders discharge to the scale hoppers. When the batch is completed, it is discharged to a gathering conveyor by means of vibrating feeders. This empties into the mixer leg which runs to the top of the mixer house. The leg discharges to a hopper scale which in turn discharges to the mixer. After being mixed, the material is discharged to a surge hopper.

The small ingredients are weighed manually and fed through a hopper on a vibrating feeder. A spout is provided from bin No. 8 (west cullet bin) to the material elevator so that this bin may be used as a spare bin for any material. Provisions are made for emptying any bin through hopper scales above the mixer by means of car loading spout to tracks (Fig. 10). Bin level indicators are installed in each bin to register and blow a horn when the bin is full.

Mixing Cycle and Interlock

Scales and Feeders: At start of the cycle, the scale hopper above the mixers has one charge of batch materials and scales No. 1, No. 2, and No. 3 have their materials weighed and ready for discharge.

The operator pushes one master control button which starts one complete mixing cycle (button to be reset for next cycle). When the operator pushes the button, the mixer, gathering belt, and gathering elevator starts and runs until the mixer has discharged and stops. The gate on the hopper scale above the mixer opens when the operator pushes the control button, provided correct amount of material is in the scale. It remains open until the scale reaches zero tare weight and then closes. When the gate closes, the discharge feeders from scales No. 1, No. 2, and No. 3 start discharging. These feeders are interlocked so that they will not start unless their respective scales have proper amount of materials in their hoppers. Feeders are interlocked to shut off when their respective scales reach zero tare weight.

The small ingredient feeder is interlocked by means of a Jeffrey bin eye so that the other discharge feeders will not start unless there is a charge in place in the hopper above this feeder. The small ingredient feeder starts discharging simultaneously with the discharge feeder on Scale No. 3. It shuts off when discharge feeder from scale No. 3 shuts off.

The feeders from bins to scales are interlocked to start ten seconds after the discharge feeders from scales to belt conveyor have stopped. The No. 1, No. 2, and No. 3 feeders start simultaneously. The feeders sequence as follows:

Scale No. 1: Bin No. 1 or Bin No. 7 (Sand). Then Bin No. 4 or Bin No. 10 (Cullet).

Scale No. 2: Bin No. 6, Bin No. 3. Then Bin No. 9.

Scale No. 3: Bin No. 5. Then Bin No. 4 or Bin No. 10 (Soda).

The feeders are interlocked with the scales so that they operate in the above sequence and so that they operate at full capacity about 95% of time, dribble feed last 5%, and then shut off when they have discharged their specified amount into the scales. Not more than two minutes' time is required to satisfy each scale with all its materials. Loading the Buffalo scales at this speed does not adversely affect their accuracy.

In addition to the interlocked automatic system, provisions have been made for the individual control of each feeder, the mixer, and the gathering belt and elevator. However, the gathering belt is interlocked so that it cannot operate separately from the elevator.

Signal lights indicate each scale hopper FULL or EMPTY; each feeder ON or OFF. Signal lights also indicate that each material (excepting small ingredients) has been weighed.

Scale and Mixer: The gathering elevator discharges into a hopper scale above the mixer. Discharge from this scale is by means of an air-operated slide gate controlled by a solenoid air valve interlocked so that the gate opens when the operator pushes the master control button, provided the scale has received its correct amount of materials. It remains open until the scale reaches zero tare weight and then closes.

It is also interlocked with the mixer so that the gate will not open until the mixer is empty and discharge on mixer is in OUT position. It is also interlocked so that when gate closes, the feeders from scale hoppers to gathering belt on scales No. 1, No. 2, and No. 3 start operating. Signal lights indicate scale FULL or EMPTY, gate OPEN or CLOSED.

Unloading Material in Proper Bin

The very thought of getting a carload of batch material in the wrong bin in this completely closed system is a nightmare to operating personnel. In an effort to prevent this unmentionable thing from happening, we use

(*Continued on page* 212)

THE A. C. S. ANNUAL MEETING

Pittsburgh, where the Glass Division was founded thirty-three years ago, will play host to the Society's membership during its fifty-fourth Annual Meeting.

In 1919 the Glass Division of the American Ceramic Society was organized in Pittsburgh and it is in this city that the Glass Division will hold its sessions during the fifty-fourth annual meeting of the Society beginning Sunday, April 27, at the Hotel William Penn. The last annual meeting to be held in Pittsburgh was in 1943.

Of the more than one hundred and forty papers scheduled for presentation in the sessions of the Society's eight divisions, seventeen papers will be presented at the Glass Division meetings. K. B. McAlpine, Pittsburgh Plate Glass Company, is Division Program Chairman.

While, as in the past, glassmen will find their real interest in the Glass Division sessions, certain phases of the over-all program will afford some interest to the glass members; for example, the sessions of the Basic Science Division at which will be presented twenty-four papers. This Division will also hold a joint meeting with the Refractories Division for the presentation of five papers.

One of the features of the Basic Science Division will be a symposium on hydrothermal research. Papers will be presented by G. W. Morey, Geophysical Laboratory of the Carnegie Institution of Washington; E. F. Osborn, Pennsylvania State College; A. C. Walker, Bell Telephone Laboratories; and G. L. Kalousek and Daniel Mui, University of Toledo.

Fundamentals of the phase rule and its use will be discussed by W. R. Foster, Champion Spark Plug Company, and S. J. Zerfoss of the Naval Research Laboratory, will present a review of Ostwald's Steps-Rule. W. J. Knapp, University of California, will discuss the relation of free energy in phase diagram construction.

The structural relationships of double oxides of trivalent elements will be discussed by M. L. Keith and Rustum Roy of Pennsylvania State College, and the strength of high-temperature materials will be the subject of J. A. Stavrolakis of General Electric Company. A paper on the thermal dissociation, reassociation and synthesis of zircon will be presented by C. E. Curtis and H. G. Sowman, Titanium Alloy Mfg. Division of National Lead Company, and Gilbert Goodman, from General Electric Co., will discuss the ferroelectric properties of lead niobate.

Equilibrium studies on the systems, CaO-MgO-SiO_2, MgO-FeO-Fe_2O_3-SiO_2, MgO-TiO_2, BaO-B_2O_3-SiO_2, Li_2O-Al_2O_3-SiO_2 Li_2O-MgO-Al_2O_3-SiO_2, and also on the Kaolinite-water and fluorosilicate systems will be presented by the following persons: R. W. Ricker, E. F. Osborn, Arnulf Muan, F. A. Hummel and M. D. Karkhanavala of Pennsylvania State College; L. W. Coughanour, V. A. DeProsse, E. M. Levin and G. M. Ugrinic, of the National Bureau of Standards; A. L. Johnson and K. C. McCartt, Universal-Rundle Corp.; and Wilhelm Eitel from the U. S. Bureau of Mines.

The program will also include papers on research methods and equipment. H. E. Kissinger, National Bureau of Standards, will present a method of studying dehydration reactions. A recording analytical balance and high-temperature centrifuge will be described by F. A. Mauer, T. F. Newkirk and Fred Ordway, of the National Bureau of Standards. N. N. Ault and H. F. G. Ueltz of the Norton Company will present an investigation of the modulus of elasticity of solid bodies by sonic methods. And R. A. Humphrey and E. C. Worden, U. S. Bureau of Mines, will describe some precision controlled electric furnaces for temperatures up to 1500°C.

In the Enamel Division, a paper will be given by A. E. Pavlish and L. S. O'Bannon, of Battelle Memorial Institute, on an investigation of the use of antimony oxide for opacifying enamels and glasses. A symposium on the availability of materials is part of the program of the Materials and Equipment Division, which will include a discussion on government regulations on critical materials by a representative of N.P.A. In the Refractory Division, R. G. Abbey will deliver a paper on glass melting refractories.

Samuel G. Hibben, Director of Applied Lighting for the Lamp Division of Westinghouse Electric Corporation and President of the Illuminating Engineering Society, will be one of the general session speakers. He will speak on "Bottles for Light—A Problem for Tomorrow." Six panel members and a moderator will discuss "What the Industry Wants a Ceramic Engineer Taught Before Graduation." The panel discussion will be part of the Institute of Ceramic Engineers' program, meeting in joint session with the Education Council of the Society.

(*Continued on page 214*)

SAMUEL RAY SCHOLES —

BLEININGER MEDALIST

In the presence of over 230 members and guests of the Pittsburgh Section of the American Ceramic Society, on March 14 Dr. Samuel Ray Scholes was presented with the fifth annual Albert Victor Bleininger Memorial Award "for distinguished achievement in the field of ceramics." Dr. Scholes, Associate Dean and Head of the Department of Glass Technology of the New York State College of Ceramics, Alfred University, was presented with a medal and scroll which represented the award.

Mr. Donald E. Walsh, of Consolidated Feldspar Corporation and Chairman of the Pittsburgh Section of the Society, presided. The toastmaster was Dr. E. Ward Tillotson, Director of Research at Mellon Institute, the winner of the second Bleininger Award in 1949, and a past president of the American Ceramic Society.

The featured address of the evening was delivered by Dr. Alfred E. Badger, Research Supervisor, Libbey-Owens-Ford Glass Company, in the absence of Mr. Donald E. Sharp, also of Libbey-Owens-Ford, who was unable to attend because of illness. In the interesting and entertaining talk entitled "Glass—Then and Now", Dr. Badger, with the aid of many lantern slides, described the progress which has been made in the glass industry during the past 40 years. This period was chosen to parallel the Award recipient's career as a researcher and educator in the field of glass technology. It has seen the evolution of many new glass products, from glass which can be heated with a flame on one side while supporting a cake of ice on the other, to glass clothing.

Describing Dr. Scholes as a man "equipped with a keen mind, an excellent background of graduate training and industrial experience, and teaching skill," Dr. M. Ellis Drake, President of Alfred University, praised the medalist for his services and contributions to ceramic education. "His liberal and progressive philosophy of education, his sound scientific training and background, and his appreciation of the liberal arts," said President

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The Bleininger Award Dinner, March 14, 1952

QUALITY CONTROL IN HAND PLANTS

By NEVIN A. CORT, JR.

Bryce Bros. Co., Mt. Pleasant, Pa.

For years we people in the hand glass industry have been collecting data which has led to systematically controlled batches, temperature control and the careful selection and analyzing of raw materials. In fact, we have been using quality control in a limited manner. This has been done with very satisfactory results, proving that control of any nature is absolutely essential in the glass industry today. We have also collected data on shop losses, lehr breakage and finishing losses. This paper will deal with these losses, the study and control of which has not been investigated as thoroughly as possible.

According to E. L. Grant, Executive Head of the Department of Civil Engineering, Stanford University: "Statistical Quality Control should be viewed as a useful tool for the solution of many manufacturing problems that cannot be solved so well by any other known method." During World War II its application to industry demonstrated its possibilities in many different types of manufacturing. Although its uses are limited, universities such as Purdue, Illinois, Carnegie Tech. and many others realize its importance and are offering quality control courses. This alone should convince us of its importance in industry. In discussing quality control, I will endeavor to point out certain processes of control in hand-blown manufacturing with which I am most familiar and where I have seen its uses applied. I will not go into details but will try to show the importance of control charts and control methods.

I. Shop Losses

Supervising inspection properly is a very difficult and important job. Shop inspection by workmen themselves can be carried out in most hand-blown glass plants. Although this is done under the supervision of the foreman, the procedure is very similar to a double sampling system. The men on a blown shop in the best position for such a spot inspection are the cutting-down or straightening-up boy and the finisher. The cutting-down boy examines ware for such defects as cords, stones, blisters, mold marks and defective workmanship on the part of a blower. He, in turn, if the situation warrants it, notifies the blower. If the necessary correction cannot be made in the shop, the foreman is called to make the adjustment needed. The finisher in the shop is the final inspector. He not only inspects the bowl for defects that have passed the cutting-down boy but also inspects the stem and foot. By applying such a system, much imperfect ware is discarded at the source of forming. Men working on an unlimited turn work basis are hard to convince that ware should be discarded in the shop. However, once the system is put into effect, they realize the benefits derived from it, mainly good ware on the books and a percentage of excess. This does not eliminate the 100 per cent inspection after annealing, but does reduce the handling and inspecting of defective ware.

Presented before the Twelfth Conference on Glass Problems, University of Illinois, Urbana, Illinois.

II. Lehr Breakage

In most cases, the arithmetic in quality control is very simple and control chart data can be kept by shop help. Temperature control charts are kept religiously in annealing. Fraction defective charts on breakage should be kept as well. Most plants do keep a score on lehr breakage, but the score alone has no story to tell. A fraction defective chart on breakage, if correctly used with the data compiled, can give you an exceptionally good history of the ware made. It is necessary to keep correct data on each shop's breakage and types of ware made. If the breakage goes beyond the upper control limit specified, an assignable cause can be found by referring to the data sheet. Breakage in some stemware items, formerly attributed to workmanship, have been found to be caused by defective molds. A few years ago excessive breakage on certain items was attributed to just one of those things that happens in a glass plant. Since control charts have been used on lehr breakage, much has been done on cutting the breakage to a minimum. Forming methods, such as weight distribution in the bowls of items, have been changed. This has eliminated breakage at the stick or where the stem is pressed on to the bowl. Mold designs have been changed in such a way as to make the items more durable, yet not enough to change their appearance noticeably from their former specifications. By the use of these charts, I have seen lehr breakage cut as much as 2 per cent, which is quite a saving over a period of months.

III. Finishing Department Losses

Control charts in the Finishing Department are exceptionally useful. From day to day, a chart can tell you the per cent of loss in cutting off, grinding, glazing and the defective ware that has slipped through the inspectors. These are all assignable causes and can be kept to a minimum with proper cooperation between the department head and workmen. As in control charts on breakage, the data must be correct and referred to in conjunction with the charts. In the past year, I have seen glazing machines redesigned and methods of glazing ware changed due largely to control methods. For example, a turn of goblets were made and 310 pieces out of 325 were found to be good at the lehr inspection. After they were cut off and ground, there were still 306 pieces good. Upon glazing the ware, the selectors found 82 pieces with a fine check in the bottom of the bowl where the stem was pressed on to it. In checking over former charts on this particular item, it was found that invariably upon glazing a certain percentage of pieces were checked in this manner. Although the percentage was considerably less than in this instance, the check was there. It is not always easy to find an assignable cause for such breakage. However, after much checking and really through a process of elimination, the trouble was found to be in the stem mold itself. This mold required a very small amount of machining to correct it. If a

(*Continued on page* 218)

A KOREAN GLASS FACTORY

By LT. (jg) WILLIAM G. WEPFER AND LT. (jg) HAROLD BROWN, USN

In war-torn Korea manufacturing industry left from the the Japanese regime of industrialization is practically non-existent. Among the rubbled factory skeletons of Inchon, only one small glass factory miraculously escaped destruction. Here we observed a father, employing his children as labor, practicing the ancient art of glass blowing. The artisan had only a slight appreciation for the chemical constituents of glass but knew that in the pre-war days a fine silica sand from the Changsan-Got region of North Korea was shipped by junk to Inchon. It was then melted and fused with sodium and calcium carbonate to form his raw product of soft glass. Due to their limited availability, none of the raw materials were being compounded into glass at the time.

The shop was, however, engaged in the process of blowing small glass bottles. These were employed by the merchants to contain a colored sugar-water mixture which enjoyed a high degree of salability among the natives. The basic material for this process was gathered by his six children who roamed the waterfront and streets of Inchon picking up and gathering stray and broken glass. This was returned to the shop, broken into small pieces approximately one inch across and then crushed. The resulting fine glass powder then served as the main constituent of the charge. The furnace was lined with diatomateous earth blocks which were manufactured on the Korean island of Kwanghwha-Do. In addition to serving as lining, the bricks supported a 3-gallon clay crucible over the coke-fed fire. The glass charge was fired until molten and was taken to a cherry-red heat judged solely by eye. When this has occurred, the blower stands majestically before his furnace and dips a four-foot glass rod into the molten charge. With a deft twist of the wrist, a glob of liquid glass is removed from the crucible and adheres to the end of the rod. The operator blows slightly to insure a continuous bubble, places the bubble in a permanent iron mold hand-operated by his small son, who is very conscientious and serious about his job, and blows the molten glass against the sides of the mold. With a final strong gust of breath, he necks and breaks the molded form from the blowing tube and repeats the process. The little fellow drops the finished products from the mold into a box of pulverized coke where it is cooled momentarily before being transferred to the annealing box cleverly set in the updraft of the furnace exhaust gases. The number of cracked bottles caused by adverse temperature gradients were thereby minimized. The process all told required some 20 seconds per article, giving him a maximum production of approximately 180 per hour. The finished product had a rough surface finish and was colorless except for a slight greenish tinge. This was due to a small iron concentration in the charge which was deoxidized in the reducing atmosphere of the coke-fired furnace. Imperfections and breakage resulted in approximately 10-15% scrap which

(*Continued on page* 218)

RECENT TRANSLATIONS OF RUSSIAN PAPERS OF INTEREST TO THE GLASS INDUSTRY

Abstracts of two papers which appeared in the Russian journal of the glass and ceramic industries.

Strength of Hardened Glass

A theoretical and experimental work on the strength of hardened glass has been published by G. M. Bartenev and V. I. Rozanova in *Steklo i Keramika* (Glass and Ceramics) 1951, No. 7, p. 10-14, as continuation of the paper abstracted in THE GLASS INDUSTRY, July 1951, p. 356.

The surface of glass is weaker than its interior because of superficial leaching and flaws. In annealed ware the ratio of strengths inside and at the surface is about 4 to 1. Rapid cooling produces compressive stresses in the surface layers. When tensile stress is applied to a rapidly cooled specimen, a part of this stress is neutralized by the former stresses, and the surface layer is stronger than after annealing. This layer is still weaker than the interior of the specimen, but the difference in strength between exterior and interior layers is smaller. Thus to find out the breaking stress P of a hardened specimen, the compressive stress f in the surface has to be calculated and the value of f added to the breaking stress P_0 of the specimen before hardening. In the mathematical language

$$P = P_0 + f \qquad (1)$$

The value of f increases with the degree of hardening. If the birefringence produced by the hardening is Δ (centimeters path difference per centimeter thickness) and the optical stress constant is B (square centimeters per kilogram weight), then

$$f = \frac{K\Delta}{B} \qquad (2)$$

In this equation Δ is found by experiment and B can be calculated as soon as the chemical composition of the glass is known. The number K is a function of another number I which is calculated from the equation

$$I = \frac{\Delta(1-\sigma)}{B\beta E T_g} \qquad (3)$$

σ is Poisson's ratio, β is coefficient of linear thermal expansion (in inverse degrees C.), E is Young's modulus (in kg. weight per square centimeter), and T_g is the difference between the temperature of "solidification" of glass (near 575° C. for customary glasses) and the temperature of the cooling medium. The relation between K and I is complicated, but the general trend is clear from the table calculated by Bartenev and Rozanova and reproduced here in an abbreviated form:

I	K	I	K
0.0004	2.00	0.356	2.70
0.0038	2.00	0.421	2.94
0.0105	2.01	0.470	3.17
0.0344	2.04	0.514	3.46
0.0912	2.13	0.553	3.79
0.163	2.23	0.582	4.11
0.214	2.34	0.617	4.63
0.289	2.50		

This table is valid for plates only.

Thus the calculation of P involves the following steps: (a) calculation of B, (b) calculation of I from equation (3); (c) finding K from the table, (d) calculation of f from equation (2), and (e) introduction of f into equation (1). The results of such a calculation are shown in Fig. 1, lower curve. The ordinate of the curve is the bending stress causing rupture (in metric tons per square centimeter) while $\frac{10^7}{540}\Delta$ is plotted along the abscissa.

Experiments were performed to test the above theory. Glass slabs of 120 x 24 x 6 mm. were hardened in an air blast, and the birefringence and the bending stress causing rupture were determined. For every point shown in Fig. 1, at least 12 specimens were measured.

It was observed early that rupture starts at the edges between the 120 x 24 and 120 x 6 mm. faces. Therefore, the stress at rupture depends on the conditions of cooling these edges. If the 120 x 6 faces are not protected and heat is lost also through them, the edges are particularly well hardened, and the bending stress at rupture is greater than predicted by the theory. The upper curve (marked 2) of Fig. 1 represents the dependence of breaking stress (the ordinate) on degree of hardening (the abscissa) for specimen cooled in this manner. It is seen that the stresses are greater than the predicted stresses shown as curve 1.

When the narrow faces (120 x 6 mm.) were covered with a heat-insulating layer of asbestos (6 mm. thick) and the heat escape through them was thus intercepted, the breaking stress was smaller and agreed with the theoretical prediction, at least at low degrees of hardening. The black circles in Fig. 1 represent the experimental data for such (partly insulated) sheets. It is seen that they are on or near the theoretical curve up to $\frac{10^7\Delta}{540} = 3$. At higher degrees of hardening the surface may be stronger than the middle of the plate; then rupture starts in the middle and, consequently, is independent of the degree of hardening.

The above theory accounts for the enhanced resistance of hardened glass to tensile and bending stress. However, the enhanced resistance to impact is even more important to the users of hardened glass plates. Bartenev

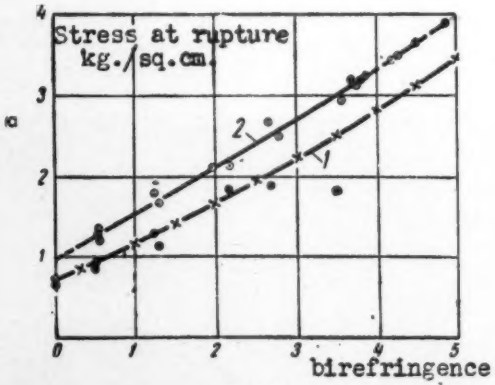


Fig. 1.

and Rozanova hope soon to extend the theory so as to include the impact tests.

Aerodynamic Resistance in Tank Furnaces

In many Russian glass works, the output is limited by the volume of gases which can be removed by the existent structures. L. I. Motorina discusses the possibilities of increasing this volume in *Steklo i Keramika* (Glass and Ceramics) 1951, No. 7, p. 4-10.

When preparing plans for tank furnaces, several aerodynamic resistances often are disregarded. These omissions include pressure drops (a) for achieving the necessary gas velocity. This pressure drop is $W^2\gamma/2g$, W being the linear rate of flow at the actual temperature of the gas, γ the specific gravity of the gas (dimensionless), and g acceleration due to gravity; (b) in regenerators; if n rows of checkers are present, this pressure drop is $W^2n\gamma/2g$; (c) because of sudden enlargement or contraction of the cross-section of the channel; this pressure drop is

$$\left(1 - \frac{F_1}{F_2}\right)^2 \frac{W^2}{2g}\gamma,$$

if F_1 and F_2 are the two cross-sectional areas, and (d) caused by the volume increase of the flue gases between the ports and the chimney stack, due to sucking-in of air. All these resistances are measured in mm. or inches of water.

For a particular tank furnace studied by Motorina, the following resistances (all in mm. water) were calculated: burners 3.00, regenerators 1.58, gas regulator of the drum type 7.99, Klegg valve 6.98, and flue 5.59. Substitution of a sliding door for the drum gas regulator would lower the resistance by 7.99 mm., and an additional saving of 1.64 mm. can be achieved by eliminating the right angle bend in the pipe. Clogging of the regenerator by dust and glass greatly increases its resistance. Thus, if the working cross-section of the regenerator is reduced by one-half, the pressure drop increases from 1.58 to 6.94 mm. water.

To be sure that the draft in the furnace will be sufficient also at the highest clogging just before the shutdown of the furnace, driving pressure of 38 mm. would be necessary. An underpressure of this amount is given by a chimney 75 meters high, while no chimney in a Russian glass works is taller than 60 meters, corresponding to an underpressure of 30 mm.

This underpressure depends not only on the length of the stack, but also on the temperature drop in it. The above values are calculated on the assumption that the temperature of the flue gases at the base of the chimney is 300°C. However the gases often are colder than that, and the draft suffers correspondingly. It is necessary to heat-insulate the path of the flue gases so that the temperature decreases between the base of the regenerator and the base of the chimney stack by not more than 50°C. The flue gas of the machine channels should not be mixed with that of the furnace itself, as the temperature of the former is only about 150°. This recommendation has been carried out in several plants.

Finally, the chimney can be assisted by an exhauster.

ANNUAL REPORTS OF GLASS COMPANIES AND SUPPLIES

Consolidated sales and earnings of Corning Glass Works and domestic subsidiaries in 1951 were the second largest in the company's history. Sales amounted to $115,750,172, compared to the previous year's record of $116,473,981. Net earnings, after taxes, were $10,141,164 or $3.70 per share of common stock last year, compared to $17,612,355 or $6.53 per share in 1950. Corning's share of the combined 1951 earnings of its three domestic affiliates in the United States—Dow Corning Corporation, Owens-Corning Fiberglas Corporation and Pittsburgh Corning Corporation—was $3,497,674 compared with $4,215,287 in 1950.

American Potash & Chemical Corporation reported net earnings of $1,970,622 for the year compared with $2,599,911 during 1950. After allowance for preferred dividend requirements, earnings on the Class A and B stocks amounted to $3.24 a share for 1951 against $4.34 a share in 1950. Sales for last year were $17,749,144 compared with $17,144,550 for 1950.

In its annual report, Mathieson Chemical Corporation showed net earnings, after Federal income and excess taxes of $11,975,000, in the amount of $9,652,993, compared with $8,994,014 in 1950, an increase of 7.3 per cent. Sales totaled $91,234,076, compared with $75,775,757 in 1950, an increase of 20.4 per cent.

Hazel-Atlas Glass Company reported net earnings, after taxes, of $3,370,136 equivalent to $1.55 per share as compared with $3,604,442 equivalent to $1.66 in 1950. Net sales were reported to be $69,883,740.

Net earnings of Diamond Alkali Company for 1951 totaled $6,674,297, an increase of 38 per cent over the $4,829,620 reported for 1950. This is equivalent, on the basis of the common shares outstanding at the end of 1951, to $2.95 per share compared to $2.14 in 1950. Net sales for 1951 were $80,748,796, an increase of 45 per cent over the $55,702,575 total for 1950.

Thatcher Glass Manufacturing Company, Inc. showed sales for 1951 at $23,064,944, an increase of 22.4 per cent over the $18,842,272 volume for 1950. Net income, after charges and taxes, was $1,097,365. This is equal, after preference dividends, to $1.99 per share. It compares with net income of $972,605, or $1.66, in 1950.

In its annual report, Lynch Corporation reported sales of $8,165,867 as compared with $8,519,270 for 1950. Net income, exclusive of special credits, amounted to $744,332, compared with $1,064,392 in 1950.

General Refractories Company reported sales of $55,273,322 compared with $38,198,720 in 1950. Net earnings were $3,960,584, or $8.42 a share, which compared with earnings of $3,518,210, or $7.48 per share, in 1950.

Total net income for 1951, reported by The Carborundum Company, was $6,474,692 equal to $4.24 per share, compared with $7,530,859 equal to $4.93 per share in 1950 on the basis of the three-for-one common stock split on March 22, 1951. Net income of $4,751,098 equal to 73 per cent of total net income was received from domestic operations.

• The ECA has awarded its "Certificate of Cooperation" to Owens-Illinois Glass Company for the training given to several groups of technicians and engineers who came to the United States to study our economy.

Inventions and Inventors

Feeding and Forming

Glass Stirring Device. Fig. 1. Patent No. 2,586,079. Filed June 25, 1949. Issued Feb. 19, 1952. Three sheets of drawings. Assigned to Emhart Manufacturing Company by Karl E. Peiler.

This is a device for stirring and mixing the molten glass in a forehearth which delivers glass to a feeder. It includes three vertical stirrers 7, each having a screw threaded portion 7b at the lower end. Novel means are provided for rotating the stirrers by a chain 7l and provision is made for removing and replacing the stirrers.

The patent contains two claims and the references cited were 191,417, Foster, May 29, 1877; 984,850, Rathbun, Feb. 21, 1911; 2,217,182, Peiler, Oct. 8, 1940; 2,238,800, Mueller, Apr. 15, 1941; 2,467,809, Cannon et al., Apr. 19, 1949; and 187,836, Great Britain, Nov. 2, 1922.

Furnaces

Electric Melting Method. Patent No. 2, 585,761. Filed Dec. 27, 1948. In France Jan. 13, 1948. Issued Feb. 12, 1952. No drawings. Robert Gallois, Paris, France, inventor.

This patent contains two claims, the first being as follows: A method for transforming a glass batch into fused and refined glass which comprises: first, heating the batch by electrical resistances until its electrical conductivity is located between $10^{-6}ohm^{-1}cm.^{-1}$ and $10^{-3}ohm^{-1}cm.^{-1}$, these limits corresponding to temperatures of about 400 and 600 degrees C. for ordinary soda-lime glass batches, then heating the batch by Joule effect in its mass up to the point where the endothermic reactions of its components on one another are completed,

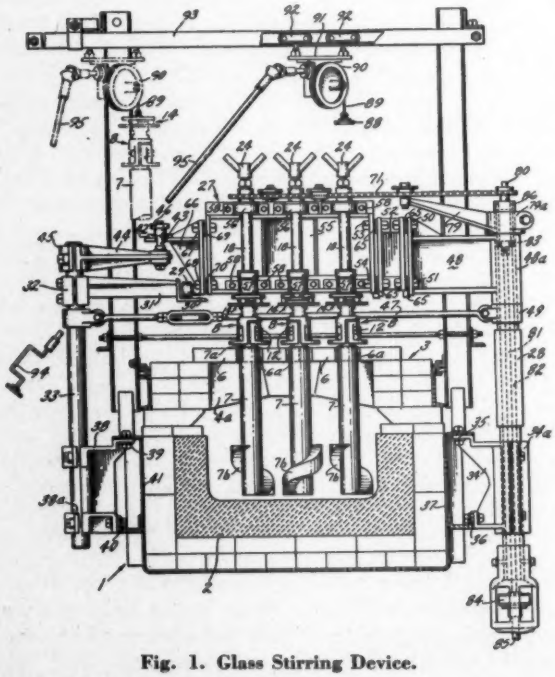


Fig. 1. Glass Stirring Device.

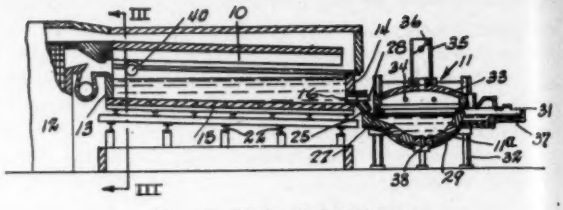


Fig. 2. Method of Melting.

the mass then acting as an electrical resistance and becoming coherent, and after these two preliminary heating stages, melting the glass batch and refining the glass thus fused.

Method of Melting. Fig. 2. Patent No. 2,587,914. Filed, original application, Oct. 9, 1943. Issued Mar. 4, 1952. One sheet of drawings. Assigned to Industrial Developments Limited, Singapore, by W. J. Smith, New South Wales, Australia.

The drawing shows a melting chamber 10 and a working chamber 11. The basin 15 of the tank is substantially semi-circular in cross section and it slants downwardly toward the working chamber 11. Cooling air may be used if desired. The glass flows to the working chamber through a chute 25, this flow being controlled by a valve 28. The working chamber is substantially hemispherical in shape and is provided with a flue 35 and reheating burners. Radial forehearths 31 project from this chamber.

Batch is delivered to the tank by two batch feeders, one being shown at 40. Ordinarily the batch is not fed while glass is being delivered to the working chamber. The curved shape of the melting and working chambers is supposed to be of particular advantage.

The patent contains four method claims and nine references were cited: 762,270, Benjamin, June 14, 1904; 1,596,058, Mambourg, Aug. 17, 1926; 1,834,631, Mulholland, Dec. 1, 1931; 1,872,664, Brown, Aug. 23, 1932; 1,883,023, Slick, Oct. 18, 1932; 1,928,016, Halbach et al., Sept. 26, 1933; 1,928,598, Morton et al., Sept. 26, 1933; 31,935, Germany, July 10, 1885; and 204,189, Switzerland, Apr. 30, 1939.

Glass Compositions

Super-opaque Enamel. Patent No. 2,588,250. Filed May 1, 1946. Issued Mar. 4, 1952. No drawings. Assigned to National Lead Company by Bernard Kopelman and Eugene Wainer.

This enamel is of the acid-resistant type and is particularly adapted for use on sheet steel. The patent contains numerous tables giving examples of batch compositions, the calculated oxide content and the reflectance. The patent contains two claims, the second being as follows: A frit composition suitable for use in the manufacture of super-opaque enamels consisting substantially of 7% to 11% sodium oxide, 5% to 11% boric oxide, 35% to 55% silicon dioxide, 3% to 9% aluminum oxide, 2% to 6% zinc oxide, 7% to 11% sodium aluminum fluoride, 8% to 14% titanium dioxide and 2% to 15% phosphorous pentoxide, the proportions by weight of the oxides of sodium, boron and titanium being not more than 30% of the composition.

The references cited were: 2,339,260, Frost et al., Jan. 18, 1944; 2,347,187, Frost, Apr. 25, 1944; and 2,370,695, Stufft, Mar. 6, 1945.

Glass Wool and Fiber

Fiber Drawing Apparatus. Fig. 3. Patent No. 2,586,774. Filed Aug. 6, 1948. Issued Feb. 26, 1952. One sheet of drawings. Assigned to Lucas Development, Inc., Toledo, Ohio, by R. R. Bastian and Glenn Berkebile.

This apparatus is particularly adapted for the production of long fibers to be formed into a bonded mat. The orifice plate 12, from which the strands flow, is preferably such as shown in an abandoned application by Bastian. The strands are picked up on a porous belt 20 which has a first zone 21 connected to vacuum. These fibers then pass to a zone 22 which is connected to a source of air pressure. This blows the fibers onto a conveyor 32 from which they pass to a bonding station if desired. Any strands that break after leaving the orifices will drop vertically and can be broken off by the operator so that they will be picked up by the belt 20.

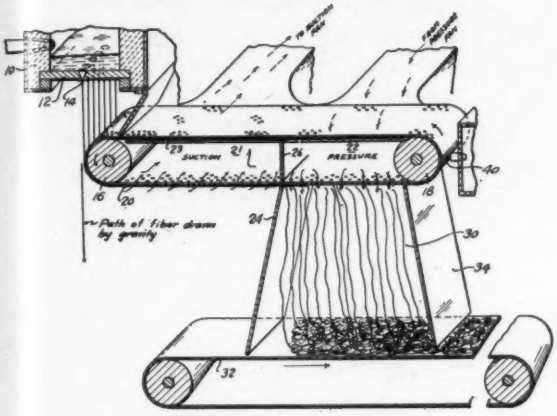


Fig. 3. Fiber Drawing Apparatus.

The patent contains three claims and eight references were cited: Re. 22,078, Newman et al., Apr. 21, 1942; 1,280,863, Saunders, Oct. 8, 1918; 2,208, 897, Dockerty et al., July 23, 1940; 2,264,345, Tucker et al., Dec. 2, 1941; 2,313,630, Dockerty, Mar. 9, 1943; 2,337,726, Rainford et al., Dec. 28, 1943; 2,450,914, Powell, Oct. 12, 1948 and 2,460,899, Modigliani et al., Feb. 8, 1949.

Miscellaneous Processes

Transfer. Fig 4. Patent No. 2,586,865. Filed Nov. 29, 1949. Issued Feb. 26, 1952. One sheet of drawings. Assigned to Armstrong Cork Company by Herbert Roselle.

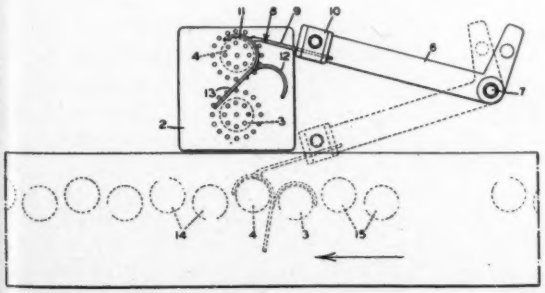


Fig. 4. Transfer.

This is a device for transferring bottles or other ware, two at a time, from a dead plate where it is cooled to the conveyor which takes it to the lehr. The figure shows a dead plate 2 with two bottles 3 and 4 which are engaged by a pusher 8 carried by a swinging arm 6. This pusher has two pockets 11 and 12 and a guide 13 so arranged that the two bottles will be turned through 90 degrees as they move to the conveyor where they are left in approximately a single file.

The patent contains four claims and the references cited were 1,742,239, Dotson, Jan. 7, 1930 and 2,363,681, McNamara et al., Nov. 28, 1944.

O. HOMMEL ESTABLISHES WEST COAST FACILITIES

Ernest Hommel, President of The O. Hommel Company, has announced the establishment of an office, warehouse and laboratory in Los Angeles. For the past 27 years the company has served the West Coast through a distributor, but because of greatly expanded sales, the company feels it can be of better service by the establishment of its own facilities. A complete stock of ceramic colors, glazes, pottery and porcelain enamel frits, enameling oxides, and chemicals will be warehoused.

Frank Welsh has been appointed Southern California Sales Representative in the newly expanded Ceramic Color and Pottery Frit Division office. Mr. Welsh has had nearly 25 years experience in color research work and is well qualified to handle his new assignment. He comes to California direct from the company's main plant in Pittsburgh, Pa.

L-O-F APPOINTMENTS

Herbert A. Fox, who has been a project engineer on the development of the Parkersburg, W. Va., factory of the new Fiber Glass Division of Libbey-Owens-Ford Glass Company has been named technical manager of the Division, it has been announced by G. P. MacNichol, Jr., Vice President.

Mr. Fox, who has been associated with Owens-Corning Fiberglas Corporation for eight years, was assigned a year ago to be project manager for the Parkersburg plant under the engineering contract between L-O-F and Owens-Corning. In his new capacity, Mr. Fox has been appointed to the Fiber Glass Division executive committee, which includes the General Manager, Factory Manager and General Sales Manager, and also to the management advisory committee.

At the same time, announcement was made of the appointment of Edward E. Hiett to the legal staff of L-O-F. Mr. Hiett, a graduate in law and business administration from the University of Michigan, has practiced with Kirkbride, Cole, Frease & Mittendorf and with Williams & Eversman prior to his joining the Libbey-Owens-Ford organization.

The appointment or transfer of seven district managers has also been announced by the company. The appointments are part of a re-alignment of the L-O-F sales force following the promotion of several executives in the L-O-F Glass sales organization and the formation of the company's new Fiber Glass Division.

GLASS INDUSTRY IN ITALY

The glass industry in Italy occupies some 360 firms with a total of about 35,000 workmen. The total productive capacity of these factories amounts to about 500,000 tons yearly. In 1950 about 290,000 tons of glass of various types were produced, and although no definite figures are as yet available for 1951, it can be reckoned that the total output during that year amounted to some 275,000 tons.

Various types of glass are represented in Italian production in following proportions (figures for 1950): 43.7%, bottles of all sizes and colors; 32.0%, glass panes and plate glass; 8.4%, green glass (demijohns and similar receptacles); 7.6%, lamps, decorations, vessels for tables, etc.; 2.8%, pressed glass for building industry, and common mosaics; 2.0%, glass for industrial and technical use (bulbs, glass wool, insulators, colored lenses, blanks for spectacles, etc.); 1.9%, technical scientific articles for laboratories and sanitation; 1.6%, art objects, artistic mosaics.

During 1951 a drop in demand for window panes and plate glass was registered and the consumption dropped from some 964,000 square metres a month to about 850,000 sq. metres, registering thus a decline of about 15%.

The production of bottles, on the other hand, picked up by about 10%. This is due to the fact that almost all factories engaged in this line have modernized their machinery.

Nothing hopeful can be said about the other branches of the industry.

A decline in home demand is one of the principal factors that is preventing the Italian glass industry from developing properly; nor are exports of glass satisfactory. It is true that during the first 10 months of 1951 Italy exported 4,768 tons of glass articles which represents an increase of 82% in comparison with the preceding year, but in comparison with the total output, this is very small. It simply means that Italian factories are now exporting 1.8% of their output instead of 0.8% as before. The fact is that, apart from works of art (which are but a small fraction of the whole), Italian factories have not succeeded in competing with other countries. In fact, on the contrary, Czechoslovakia, Germany and a few others have been succeeding in dumping substantial lots on the Italian market. Indeed, from 1950 to 1951 Italian imports of glass increased considerably as can be seen from the table below:

ITALIAN IMPORTS OF GLASS

	1950 (Jan.-October)	1951 (Jan.-October)
Glass panes and plate	13,692 tons	19,578 tons
Glass articles	9,398 tons	15,352 tons
TOTAL	23,090 tons	34,930 tons

There was one bright spot in the situation, however, and that was the great improvement as regards the supplies of fuel and raw materials. The shortage of selenium, cobalt, gold chemicals and platinum is, however, still persisting.

The most famous Italian glass factories are, of course, in Murano, but artistic glass is made also in Milan, Empoli, and Pisa. Plate glass is made at Vietri, Leghorn, Porto Marghera, Porto Valtravaglia, Pisa, Milan and Rome. The last three named cities specialize also in stamped plate glass and windows for cathedrals. Turin makes bottles; Parma, small bottles for perfumes; Rome, glass articles for the table. Tuscany is, generally speaking, engaged in the production of wine flasks and demijohns. Fidenza and Acqui make glass insulators, while bulbs are made in Milan, Lecco, Alpignano and Novi Ligure.

BALL BROTHERS ELECTS THREE NEW BOARD MEMBERS

Ball Brothers Company, Inc. has announced the election of three new members to its Board of Directors, increasing the company's directorate from eight to 11 men.

The three new directors are John P. Collett, President of Collett & Company, a midwest firm of investment banking counsellors; Robert W. Biggs, Vice President and the company's Glass Manufacturing Manager; and James L. Knipe, who only recently resigned an executive sales position with Union Bag & Paper Corporation to become Vice President and General Sales Manager of the company's commercial glass and consumer products divisions.

Mr. Collett, besides his new connection with Ball Brothers, also is a director and officer in several other midwest businesses. Mr. Biggs came to Ball a year ago from the National Electric Products Company, where he served five years as Operations Manager. Mr. Knipe joined the Muncie firm early this year.

SAN MIGUEL REPORTS NEW SALES RECORD

San Miguel Brewery, Inc., has reported a new combined net sales record of $48,223,171 for 1951, an increase of 25 per cent over 1950. Profits of the corporation's five divisions, which manufacture 24 diversified products, totalled $6,586,906 as against $6,219,907 for the previous year. Taxes paid during the year totalled $10,104,915, double the record 1950 figure.

The company's glass division marked its first full year in which glass containers were made available to other industries. Completion of a second furnace has enabled the glass division to supply approximately 70 per cent of glass container needs of the Philippines. Construction of a third furnace was started in June 1951, the report noted.

The San Miguel carton plant in 1951 supplied nearly three quarters of all Philippines demands for corrugated Kraft-paper cartons. Proposed expansion of this plant should enable it to fulfill 100 per cent of Philippine requirements by the end of 1952, the report further commented.

L-O-F OPENS SECOND FIBER GLASS SALES OFFICE

The establishment of a second special district sales office for the Fiber Glass Division of Libbey-Owens-Ford Glass Company in Chicago has been announced.

The office will be in charge of Mark Joseph Wells and follows the recent opening of a sales office in New York, which is in charge of Arnold K. McClay. Headquarters in Chicago will be at 120 LaSalle Street and Mr. Wells will work closely with W. L. Slater, District Industrial Manager, under J. Frank Gehring, Western Regional Sales Manager.

Estimation of the Thermal Expansion Coefficient of a Glass by the Measurement of Stresses Produced by Fusion to a Standard Glass

The old method of comparing the expansion coefficients of two glasses, a method which in its simplest form consists of welding the two together, drawing a fiber and looking to see which way the composite fiber would bend, is quite easy to perform and by the prudent use of a series of glasses of known expansion coefficient would allow an estimate of the value of the expansion coefficient of the unknown glass to be made. A. A. Padmos (*Sil. Ind.*, May 1951, in French) has come up with a variation which should be of interest and use to glass technologists.

The test sample of dimensions 10×10×4mm. was fused to an exactly similar standard glass block 20×10×4mm. While still hot, this was placed in a small electric furnace held at a temperature 50-100°C. above the transformation point of the test glass. The block was then allowed to cool at a rate of 1-2° per minute to a temperature 100° below the transformation zone, and finally at the rate of 10° per minute. When quite cold, the birefringence at the plane of contact between the fused blocks was measured by means of a polarizing microscope fitted with a Berek compensator, the observations being expressed in mμ per cm. The nature of the stresses (i.e., tension or compression) in the glass was determined by means of an auxiliary tint plate.

The convention was adopted of quoting all the results in terms of stress in one of the standard glasses. A series of six standards was employed, with linear thermal expansion coefficients (0-300°) ranging from 36×10^{-7} to 120×10^{-7}. An observed difference in retardation of 70 mμ/cm. corresponded to a difference of 1×10^{-7} in expansion coefficient (in the region of 20-300°). The estimated error in the observations was of the order of 25 mμ.

This practical rule did not give a complete explanation of the relationship between expansion differences and introduced stresses. The final stresses produced at an interface depended upon the difference in contraction of two glasses between two temperatures, the higher temperature being in a region between the temperature where the glass was perfectly viscous and that where it had the properties of an elastic body. For a fuller understanding, it was therefore necessary to have some knowledge of the position of the "equivalent solidification point." This was determined for a standard lead glass fused to members of a series of soda-lime-silica glasses. It was the temperature where the expansion curves of the lead glass and of a soda-lime-silica glass intersected, the latter glass being the one which produced the minimum amount of strain on fusion with the lead glass. It was then possible to calculate the birefringence produced by a thermal expansion difference of 1×10^{-7} between the equivalent solidification temperature and room temperature. The difference between the value obtained (114mμ/cm.) and that used for practical purposes (70mμ/cm.) was discussed. For example, there was a variation of stress with distance from the interface; the contact surfaces were not perfectly plane; the expansion curves might be parallel in the transformation zone, in which case the equivalent solidification temperature was below the transformation temperature; or the expansion curves were not parallel, in which case the solidification temperature was higher than the transformation temperature of the softer glass.

Suitable corrections could be applied to enable agreement to be obtained between the observed and calculated birefringence values.

Determination of Average Wall Thickness of Glass Containers, Especially Bottles

In the *Glass Review* of January and February 1951, F. Newby had translated a paper originally published by H. Freytag in *Glastech. Berichte* in 1940, which contains information of interest to those who are interested in determining the average wall thickness of glass containers.

As is well known, the wall thickness of hollow-ware can be found by using calibers or micrometers in some instances, or optical instruments in others. When using any of these methods, it is necessary to make many individual measurements of wall thickness in order to obtain a valid mean thickness.

A method to derive average wall thickness over a section of a container without the use of any expensive apparatus was described by the author. This method depended on the accurate measurement of the internal volume of the section of the container under consideration, together with the external dimensions of the section. The volume was measured by pasting a strip of paper (or marking with a wax pencil) the upper and lower limits of the part to be measured. Water was added from a burette, filling the volume from the lower limit to the upper limit. The section below the lower limit had already been filled with water. The external dimensions were measured using sliding calipers.

The following formulae were derived for average wall thickness (dm) of bottles of different shapes.

1. Value for a cylindrical bottle.

$$dm = R - \sqrt{\frac{0.3183v}{h}},$$

where R = radius of outside of bottle; v = volume; h = height of cylinder.

2. Value for a prismatic bottle of square section.

$$dm = \frac{1}{2}\left(a - \sqrt{\frac{v}{h}}\right),$$

where a = external length of side of square.

3. Value for prismatic bottle of hexagonal section.

$$dm = \frac{D}{2} - 0.5373\sqrt{\frac{v}{h}},$$

where D = diameter of circule inscribed in the outer hexagon.

4. Value for a prismatic bottle of octagonal section.

$$dm = \frac{D}{2} - 0.5493\sqrt{\frac{v}{h}},$$

(*Continued on page* 220)

Current Statistical Position of Glass

Employment and payrolls: Employment in the glass industry during January 1952 continued to drop and was reported at a preliminary 119,500. Compared with December 1951 employment of an adjusted 123,200, a drop of 3 per cent is shown. During January 1951 employment was 127,700, or 6.4 per cent higher than for January this year.

Payrolls during January 1952 fell off to reach a preliminary $34,378,955. A drop of 4.1 per cent is shown when compared with December 1951 payrolls of $35,865,163. During January 1951 payrolls were $36,599,671, or 6 per cent more than for January this year.

GLASS CONTAINER SHIPMENTS
(All Figures in Gross)

	February 1952
Narrow Neck Containers	
Foods	858,578
Medicinal & Health Supplies	1,013,355
Chemicals, Household & Industrial	586,166
Beverages, Returnable	489,999
Beverages, Non-returnable	13,043
Beer, Returnable	230,051
Beer, Non-returnable	644,296
Liquors	564,237
Wines	275,305
Toiletries & Cosmetics	479,959
Sub-total (Narrow)	5,154,989
Wide Mouth Containers	
Foods	*1,968,633
Dairy Products	199,156
Medicinal & Health Supplies	333,323
Chemicals, Household & Industrial	106,540
Toiletries & Cosmetics	135,368
Packers' Tumblers	154,554
Sub-total (Wide)	2,897,574
Total Domestic	8,052,563
Export Shipments	224,813
TOTAL SHIPMENTS	8,277,376

* This figure includes Home Canning.

GLASS CONTAINER PRODUCTION AND INVENTORY
(All figures in Gross)

		Production February 1952	Stocks February 1952
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries & Cosmetics	Narrow Neck	3,119,565	3,633,623
	Wide Mouth	*2,781,729	*2,968,780
Dairy Products		236,392	361,380
Beverages, Returnable		593,653	727,870
Beverages, Non-returnable		16,894	29,863
Beer, Returnable		324,810	342,000
Beer, Non-returnable		776,401	690,493
Liquors		479,496	875,067
Wines		285,529	359,150
Packers' Tumblers		168,311	104,611
TOTAL		8,782,780	10,092,837

* This figure includes Home Canning.

Glass container production, based on figures released by the Bureau of Census, fell off a little during February and was reported to be 8,782,780 gross. Compared with the previous month's adjusted production figure of 8,940,731 gross, a drop of 1.7 per cent is shown. Production during February 1951 was 9,200,622 gross, or 4.5 per cent higher than for February this year. Total glass container production at the close of the first two months of 1952 has reached 17,723,511 gross. Compared with production of 19,479,505 gross at the close of the corresponding period in 1951, 1952 production is off 9 per cent.

Shipments of glass containers during February 1952 also dropped to reach 8,277,376 gross. This is 4.4 per cent below the adjusted shipment figure for January of 8,662,833 gross. Shipments during February 1951 were 8,771,841 gross, which is 5.6 per cent more than shipments for February this year. Total shipments thus far in 1952 have reached 16,940,209 gross. During the corresponding period in 1951, glass container manufacturers had shipped a total of 18,491,525 gross, which is 8.3 per cent more than for this year.

Stocks on hand at the close of February 1952 were 10,092,837 gross. This is 4.7 per cent higher than the 9,635,302 gross on hand at the close of January. Stocks at the close of February 1951 were 7,631,479 gross.

On this page appears a table showing total shipments for 1951. These are preliminary figures based on information released by the Department of Commerce.

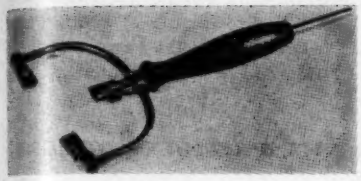
Automatic tumbler production during January 1952 jumped 28.5 per cent to reach 4,882,873 dozens. This is an increase over the preceding month's production of 3,799,888 dozens. During January 1951 production was 6,959,061 dozens. Shipments during January 1952 also

(*Continued on page* 202)

GLASS CONTAINER SHIPMENTS
(All Figures in Gross)

	1951	1950
Narrow Neck Containers		
Foods	11,528,180	11,058,238
Medicinal & Health Supplies	13,725,846	14,685,393
Chemicals, Household & Industrial	7,788,306	7,322,018
Beverages, Returnable	6,435,830	6,458,639
Beverages, Non-returnable	142,484	—
Beer, Returnable	4,524,478	3,154,738
Beer, Non-returnable	9,816,358	3,211,444
Liquors	9,644,432	9,709,075
Wines	3,219,278	3,745,470
Toiletries & Cosmetics	6,240,783	5,974,547
Sub-total (Narrow)	73,065,975	65,319,562
Wide Mouth Containers		
Foods	26,841,327	28,311,930
Dairy Products	3,517,280	3,694,783
Medicinal & Health Supplies	3,848,511	3,449,102
Chemicals, Household & Industrial	1,310,448	1,418,114
Toiletries & Cosmetics	1,603,212	1,596,960
Packers' Tumblers	1,489,075	1,465,565
Sub-total (Wide)	38,609,853	39,936,454
Total Domestic	111,675,828	105,256,016
Export Shipments	3,062,357	2,643,113
TOTAL SHIPMENTS	114,738,185	107,899,129

New Equipment and Supplies



GLASS BLOWING TORCH

Research Vacuum Supply Company, 3434 W. Montrose Ave., Chicago 18, Illinois, had announced a glass blower's hand torch which has been specifically designed for removing and sealing-off glass tubes in a vacuum system.

The new torch is a three-nozzle hand torch for a wide variety of glass blowing operations. The U-shaped fork carries three grid-type, interchangeable, fishtail burners, placed 90° apart so that the flames converge at the mid-point.

When the burner is applied to an evacuated glass tube, the flames quickly soften a narrow circular band, causing the tube to collapse at that point and seal itself off. This type of hand torch is widely employed in the manufacture of gas-filled tubes, such as neon signs, electric lamp bulbs and television tubes.

INDICATING PYROMETER CONTROLLER

Wheelco Instruments Company, 847 West Harrison Street, Chicago 7, Illinois, has announced a compact, direct reading, indicating pyrometer controller incorporating a built-in unit to provide straight-line control.

The new Model 293 presents a means of securing a type of proportioning control for processing equipment, such as ovens, furnaces, kilns, pots, vats and plastic molding machines, heretofore only obtainable through the use of auxiliary devices or complicated equipment representing a much higher investment.

METALLOGRAPHIC POLISHER

Fisher Scientific Company, 717 Forbes Street, Pittsburgh 19, Pa., has announced a new metallographic polisher which features conical drive and belt drive from a ¼-hp. motor. Polishing head speeds from 112 to 1160 rpm are provided, all at full torque, regardless of specimen pressure on the head.

Also introduced with the polisher is a 62″ x 24″ metallographic table that will accommodate two polishers. The new polisher has a nine-inch head, easily removable by means of a unique locking-clutch mechanism. The bowl, splash ring, cover and adjustable ring for holding polishing cloths are of non-corrosive metals. Speed of rotation is variable to any desired rate and is maintained automatically.

NORTON GRINDING MACHINE

Norton Company, Worcester 6, Mass., has announced a new grinding machine the Norton 4″ type CTU cylindrical grinding machine. The new machine is available as a plain machine or as a semi-automatic in work length capacities of either 12″ or 18″.

In addition to its rapid, precise grinding action, the 4″ type CTU provides outstanding operating ease. Wheel feeds and job set-up are simplified by a graduated, wheel-feed handwheel. Grinding and truing table speeds are independently adjustable, and are quickly obtained by positioning the table start-stop lever. No resetting of speeds is necessary when changing from one speed to another.

FACE-SHIELD

United States Safety Service Company, 1215 McGee Street, Kansas City 6, Missouri, has announced the development of "The Halo," a new and improved type of face-shield.

A new feature is an all-green plastic spark protector, which affords wide-angle vision and still eliminates glare from overhead lighting. Another new development is a patented visor lock which locks the visor in the "up position" or the "working position" and eliminates the chance of the wearer adjusting the visor so it does not afford full protection.

The Halo is available in three styles of headgear with clear or green visors, and a special acid resistant visor for use around acid and chemicals.

CATALOGS RECEIVED

Barnstead Still & Sterlizer Company, 203 Lanesville Terrace, Forest Hills, Boston 31, Mass., has issued a new bulletin, #124, which describes the company's convenient water demineralizer for laboratories.

The demineralizer connects directly to any water supply and delivers the demineralized water in continuous flow from 5 to 8 gallons per hour. Its seven new features, including the new direct reading type meter, are completely described in the bulletin.

American Structural Products (Mr. Ray Smolik), Sales Promotion Department, Ohio Building, Toledo, Ohio, is distributing a new booklet, "Daylight in Industry," which describes how to achieve better daylighting conditions in industrial plants through the use of light-directing prismatic glass block.

Based on research and experiments and on practical experience in hundreds of industrial buildings and schools, the booklet presents a non-technical explanation of the functions and advantages of controlled daylight for plant, factory and office.

Stephens-Adamson Mfg. Company, Aurora, Illinois, has just released a new bulletin covering its complete line of crushers. Included are Knittel ring-type crushers, both single and double rotor; single roll crushers; double roll crushers and two-stage, double-roll crushers. These units are designed for reducing glass, cullet, gypsum, sulfur, coal, coke, and other lump materials.

The new bulletin, 12-C, gives capacity and power requirements for all types of crushers. Important installation dimensions are also tabulated. Photographs and line drawings illustrate numerous installations and thoroughly explain operating principles.

Eisler Engineering Company, Inc., 750 South 13th Street, Newark 3, N. J., has issued a new catalog.

This new publication shows interesting operations in cam milling and jig boring and describes plant facilities.

Brown Instruments Division, Minneapolis-Honeywell Regulator Company, Wayne & Windrim Avenues, Philadelphia 44, Pa., is distributing Specification Sheet 306 which is devoted to Butt-welded Thermocouple Element Construction.

The sheet describes and illustrates the butt-weld thermocouple, including line drawings of response curves and a table showing improvement in response speed.

Fischer & Porter Company, Hatboro, Pa., has issued a new 40-page handbook to aid in the selection and sizing of variable-area meters.

The illustrated handbook contains, in condensed form, the results of fifteen year's research by the company's Fluids Engineering Department. A complete description of variable-area meters, tubes and floats and their comparison with variable-head meters, as well as calibration prediction data, has been included.

Bailey Meter Company, 1050 Ivanhoe Road, Cleveland 10, Ohio, has made available a new 24-page, tri-colored bulletin, #1023, which gives a detailed account of tried-and-proved automatic combustion control techniques for oil and gas fired boilers.

Comprehensive illustrations and descriptions include lucid diagrammatics showing nine typical firing methods and 16 major control equipment components. There are also individual facts and figures on 300 installations throughout the U.S.A., ranging from 6,000 to one million lbs./hr. capacity.

CURRENT STATISTICS . . .
(*Continued from page* 200)

over the 3,352,290 dozens shipped during December 1951. Shipments during January 1951 were 6,831,437 dozens. Stocks on hand at the close of January 1952 were 11,836,503 dozens, as compared with 11,579,169 dozens on hand at the close of December 1951 and 9,601,931 dozens on hand at the close of January 1951.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware increased 16 per cent during January 1952 to reach 3,005,025 dozens. This is in comparison with the 2,589,424 dozens sold during December 1951. Sales during January 1951 were 3,666,519 dozens. Total manufacturers' sales during the 12-month period ending February 1952 were 38,477,714 dozens. This is 4.8 per cent less than the 40,455,302 dozens sold during the corresponding period in 1951.

JOINT MEETING OF CERAMIC ASSOCIATIONS

The annual joint meeting of the Pennsylvania Ceramic Association and the Philadelphia Section of the American Ceramic Society was held during March.

The program included a short report on the current ceramic activities of the School of Mineral Industries by E. C. Henry, Chief of the Division of Ceramics of Pennsylvania State College. H. A. Heiligman, President of the Pennsylvania Ceramics Association, reported on the Association's activities. Brief, practical technical reports were presented by two Penn State ceramics graduates, now associated with the Armstrong Cork Company: "Processing of Glass Sands in South Jersey" by R. F. Scott, Plant Chemist, and "Some Observations on the Performance of Refractories in Glass Furnaces" by W. T. Bramlett, Plant Engineer.

CHAS. TAYLOR VICE PRESIDENT RESIGNS

Edward L. Bohn, Vice President of The Chas. Taylor Sons Company has resigned his position with that company.

Mr. Bohn has been connected with the organization for the past 15 years, and for the past ten years has been in charge of production, engineering and labor relations. For 15 years prior to joining Chas. Taylor company, he was in sales work for the North American Refractories Company. Mr. Bohn has no definite plans for the future.

THATCHER APPOINTS NEW YORK CITY SALES MANAGER

Charles A. Scully has succeeded Joseph L. Stevenson as Sales Manager of the New York City office of the McKee Division, Thatcher Glass Manufacturing Company, Inc., according to a recent announcement.

During the past year and a half, Mr. Scully has served as Sales Manager of the Chain Store Division of McKee Glass Company, before McKee's recent merger with Thatcher. Mr. Scully will continue to handle national chain store sales, as well as his new duties.

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Complete Glass Plants and Equipment, Batch Systems, Glass Melting & Sodium-Silicate Furnaces, Batch Feeders, "Schmid" Mechanical Gob Feeders, "Liberty" Pneumatic Gob Feeders, Automatic Handling Equipment, Stackers, Lehrs, Machines, etc. for manufacture of containers, flat glass, pressed ware, and tubing. Furnace Repairs and Rebuilding. Process Engineers.

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C. J. PHILLIPS NAMED VICE PRESIDENT OF DUNBAR GLASS

C. J. Phillips has been named Vice President of Dunbar Glass Corporation, H. E. Payne, President of the corporation has announced. Mr. Phillips comes to Dunbar from the Pittsburgh Corning Corporation, where he has been Manager of double glazing sales. He had previously held executive positions with Pittsburgh Plate Glass Company and Corning Glass Works.

Mr. Phillips is the author of "Glass: The Miracle Maker" and "Get Acquainted With Glass," both published by Pitman. He also has written and edited articles on glass manufacture for Encyclopedia Britannica and the P. F. Collier Encyclopedia. He has served as consultant to Rutgers University and to numerous industrial firms. A biographical sketch appears in "American Men of Science" and will shortly appear in the monthly supplement to "Who's Who in America."

At Dunbar Glass, Mr. Phillips will direct the research and development department, and assist in sales and production.

CORNING COMPLETES EXPANSION AT PARKERSBURG PLANT

A major expansion program adding approximately 75,000 sq. ft. of floor space has been completed at the Corning Glass Works plant in Parkersburg, West Virginia, by The H. K. Ferguson Company.

The project consisted of a one-story and basement section which will house additional facilities for manufacturing Pyrex piping and laboratory glassware.

HESS, GOLDSMITH NAMES FABRIC SALES MANAGER

William F. Colton has been named Manager of Decorative Fabric Sales of Hess, Goldsmith & Company, it was announced by Raymond F. Clark, Vice President in charge of the company's Industrial Products Division. Mr. Colton has resigned as Manager of decorative textile sales for Owens-Corning Fiberglas Corporation to accept the new post.

Mr. Colton has played a significant role in the development and merchandising of Fiberglas curtains and related fabric finishes. He is credited with major responsibility for originating the merchandising program which led to the creation of a rapidly growing market for Fiberglas marquisette curtains.

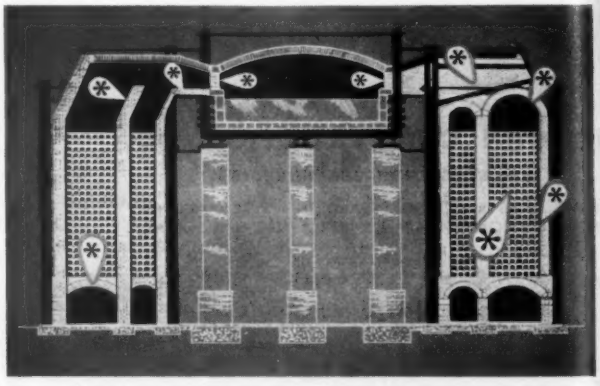
Prior to joining Owens-Corning in 1947, Mr. Colton was Assistant General Sales Manager of Comprehensive Fabrics, Inc. and was previously in the merchandising division of Talon, Inc.

where the load is hot and heavy *

in glass tank regenerator chambers, walls and arches . . . in the floors, walls, jambs and necks of the ports . . . you will get excellent service from *Ironton STEEL* First Quality Fire Brick. Ironton's control-blended Kentucky flint and semi-flint clays produce a brick which meets the rigid specifications of the glass industry. Laboratory tests have shown a fusion point of 3100°F., porosity results of 15% and deformation of 1.2% under load test.

Ironton STEEL brick stay clean in the glass tank, show an exceptionally small rate of wear, and stubbornly resist alkaline dusts. May we send samples for your consideration . . . ?

Ironton ALSET is the air-setting mortar "mated" to First Quality and Super-Duty brick. This adaptable bonding mortar or refractory cement is made from the most refractory natural crystalline aluminum silicate. Use dry type *ALSET* for non-shrinking cushion joints when you dip or trowel brickwork. Write or call Ironton 109 for suggestions on the use of *ALSET* to prolong the life of brickwork in your glass tanks.



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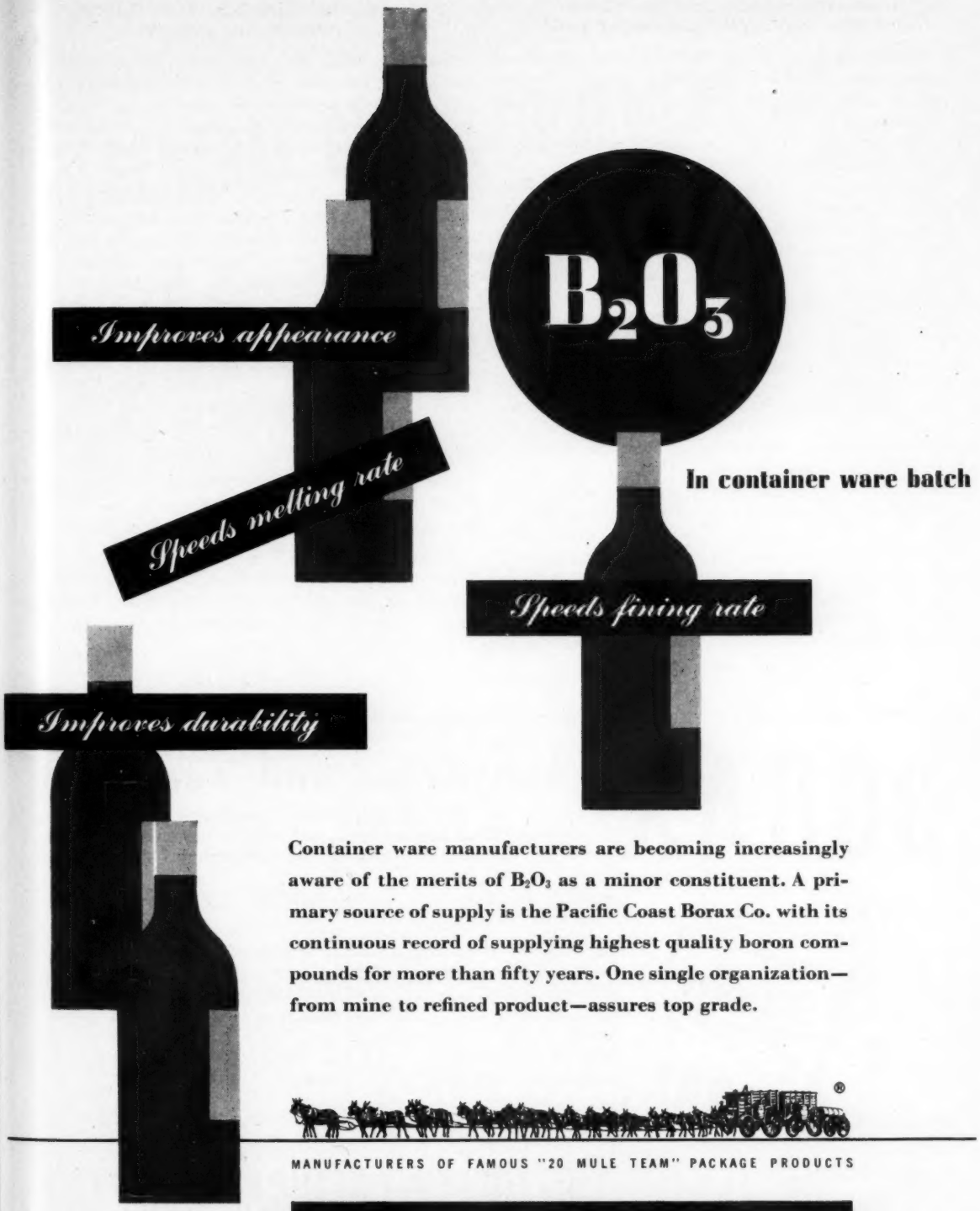

Container ware manufacturers are becoming increasingly aware of the merits of B_2O_3 as a minor constituent. A primary source of supply is the Pacific Coast Borax Co. with its continuous record of supplying highest quality boron compounds for more than fifty years. One single organization—from mine to refined product—assures top grade.

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CORNING GLASS REORGANIZES PUBLIC RELATIONS OPERATION

The consolidation of the public relations program of Corning Glass Works, Corning Glass Center, Steuben Glass, Inc., and other subsidiaries under Harlan Logan as Director of Public Relations and Howard E. Bahr as Assistant Director, has been announced by William C. Decker, President of the company.

Mr. Logan will have headquarters in the company's New York office at 718 Fifth Avenue. Mr. Bahr, as part of his duties as Assistant Director of the expanded public relations operation, will continue as Manager of the Public Relations Department in Corning. George L. Lockwood will act as New York Manager of the Public Relations office.

Mr. Logan, who edited the book "How Much Do You Know About Glass?" sponsored by Corning Glass Works during its Centennial last year, has been associated with Steuben Glass, Inc. on general public relations problems since early last year. Formerly Editor and Publisher of *Scribner's Magazine* and Editor of *Look*, Mr. Logan is also the author of several books.

Mr. Bahr, who has been associated with Corning since 1934, joined the firm in its Architectural Glass Department. In 1936 he moved to Corning to become Sales Manager of the department and continued in that capacity until late in 1937 when he was placed in charge of Corning's activities at the New York World's Fair. Following his discharge from the U. S. Army in 1936, Mr. Bahr became Manager of the Public Relations Department.

LACLEDE-CHRISTY REBUILDING COLORADO PLANT

Construction will start immediately on rebuilding the Canon City, Colorado, plant of the Laclede-Christy Company to replace an installation destroyed by fire last September. Plans to rebuild the Canon City plant were announced by J. D. Streett, President of the fire brick and refractory plant.

Mr. Streett stated that since the fire an extensive prospecting and evaluation program has been underway in the Canon City area to determine the amount and quality of clays available and to study the economic factors involved. Plans to rebuild the plant were postponed pending completion of research. The new Canon City plant will be built at an estimated cost of $100,000 and will employ 55 men.

HAYS CORPORATION ELECTS EXECUTIVE VICE PRESIDENT

Phil Sprague, Jr. has been appointed Executive Vice President of The Hays Corporation. Mr. Sprague, a Beloit College and Harvard Business School graduate, has been Advertising Manager for the past several years.

At the same time, announcement was made of the appointment of Paul B. LeBoeuf to succeed Mr. Sprague as Advertising Manager. Mr. LeBoeuf comes to Hays from the A. O. Smith Corporation where he was in charge of advertising and sales promotion.

BORAX

Anhydrous and Technical

• • • **One of the original producers of anhydrous borax offers bag or bulk carloads to the Ceramic Industry. Stauffer's Borax is dependable and trouble-free.**

TYPICAL ANALYSIS	ANHYDROUS	TECHNICAL ($Na_2B_4O_7 10H_2O$)
Sodium Borate ($Na_2B_4O_7$)	99.25 to 99.50%	52.85 to 54.32%
Boron as B_2O_3	68.00 to 68.89%	36.75 to 37.74%
Chlorides as NaCl	0.10 to 0.16%	0.04 to 0.08%
Iron as Fe	30 to 35 Ppm	2 to 8 Ppm
Arsenic as As_2O_2	20 to 40 Ppm	3 to 8 Ppm
Sulphates as Na_2SO_4	0.3 to 0.4%	nil
Carbonates as Na_2CO_3	nil	nil

•

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★ CONTRACTING ★ CONSULTING

COMPLETE INSTALLATIONS . . .
Complete Bottle, Fiber, Window and Tableware plants erected and placed in operation.

GLASS MELTING FURNACES . . .
Wide port design; electric, oil, or gas fired; regenerative or recuperative; side port or end port; capacity ½ ton to 200 tons daily extraction.

BATCH CHARGERS . . .
Ganaglass completely automatic batch charger, for glass tank furnaces from 5 tons to 200 tons daily extraction.

LEHRS . . .
Annealing or decorating; electric, gas or oil fired. Fully muffled.

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Complete oil burning systems, fully automatic, including time or temperature reversals, in connection with Generoil Burners.

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Single mould Pneumatic Presses
Duplex marble making machines
Automatic tube forming machines
Searing-off machines
Air reversing valves
Glass Fiber drawing machines
Lehr loaders, push-bar type
Bottle forming machines
Fully automatic feeders, flow or gob

Our Latest Addition

The new General Glass

MILLER AUTOMATIC GLASS FEEDER

PNEUMATIC OPERATION

Now Manufactured Exclusively by
GENERAL GLASS EQUIPMENT CO., ATLANTIC CITY, N. J.

KNOX ELECTS NEW DIRECTORS TO BOARD

At the annual shareholders' meeting of the Knox Glass Bottle Company, the following were elected as Directors: Left to right (*see cut*), Harry Aucker, New York City; Frank C. Hicks, Palestine, Texas; C. R. Underwood, Jackson, Mississippi; George B. Underwood, Knox, Pennsylvania; J. T. Helsen, Knox, Pennsylvania; W. J. Garrison, St. Petersburg, Florida. Absent, but elected to the Board, was H. H. Smith, Ridgway, Pennsylvania.

The following officers were elected at the meeting: C. R. Underwood, President; G. B. Underwood, Vice President in Charge of Sales; F. C. Hicks, Vice President in Charge of Operations; J. T. Helsel, Secretary and Treasurer; and S. H. Wyman, Assistant Secretary and Assistant Treasurer.

Plans for immediate construction of additional warehousing facilities at the plants were favorably acted upon. The management further reported that while business in the last quarter of 1951 was somewhat off, likewise year to date, the expectancy for normal volume beginning April 1 and throughout the remainder of the moving year should pretty well balance off with production.

The management also stated to its shareholders that while the policy originally established on the Knox W-D machine was to license the same to the industry, this policy has been somewhat changed, and the machine is now available to the industry upon an outright purchase basis.

GLASS FIBERS USED ON STREAMLINER TRAINS

An improved weight-saving insulating material, known as Ultralite, has been installed on most of the cars of the Pennsylvania Railroad's new streamliner trains, the Congressional and the Senator.

Made of long textile-type glass fibers bonded together with a thermosetting plastic resin, Ultralite is resilient, dimensionally stable and virtually indestructible. It is produced by the Gustin-Bacon Manufacturing Company, which states that Ultralite will reduce the pull on 15-car trains by approximately 10 to 13 tons.

E. O. SCHNEIDER, OTTAWA SILICA SALES MANAGER, DIES

Edward O. Schneider, 60, Sales Manager of the Ottawa Silica Company, died suddenly of a heart attack at his home, January 25, 1952.

Mr. Schneider was born in Buffalo, February 22, 1893, and was educated in the Buffalo schools. He was formerly sales representative for the McDougall-Butler Company and joined Ottawa Silica as Sales Manager in 1922.

Mr. Schneider is survived by his wife and two daughters.

CORNING TO CONSTRUCT NEW OPTICAL PLANT

Construction by Corning Glass Works of a new optical glass plant in Harrodsburg, Kentucky, has been announced by William C. Decker, President. Construction contract has been awarded to Ditmars-Dickman-Pickens Construction Company, Muskogee, Oklahoma.

The new plant is being built to meet the increasing demands of the armed forces for optical glass for military purposes. The plant, which will employ about 250 persons, will contain 100,000 square feet of floor space and is expected to be in operation by the end of 1952.

Named to manage the new optical glass plant is Harry S. Sterling, who has been active in the selection of the plant site and other negotiations preliminary to purchase of the plant property.

Mr. Sterling has been associated with Corning for the past seven years and joined the company in 1945 as a staff industrial engineer. His work has been connected with Pyrex brand housewares and industrial products, and optical glass.

PRESSED AND BLOWN GLASS INDUSTRY GETS WAGE INCREASE

The Wage Stabilization Board has approved a 6 per cent across-the-board wage increase, with a minimum of 8.5¢ an hour, and a number of fringe benefits for automatic machine plants, commercial mold shops, and hand and combination plants in the pressed and blown glassware industry.

The Board approved two petitions filed by the National Association of Manufacturers of Pressed and Blown Glassware and the American Flint Glass Workers, AFL. A resolution was passed authorizing the Executive Director and the Regional Boards to approve other petitions based upon the adjustments allowed in a February 14 decision, where the petitioner establishes that the plant involved has followed the pattern in the past.

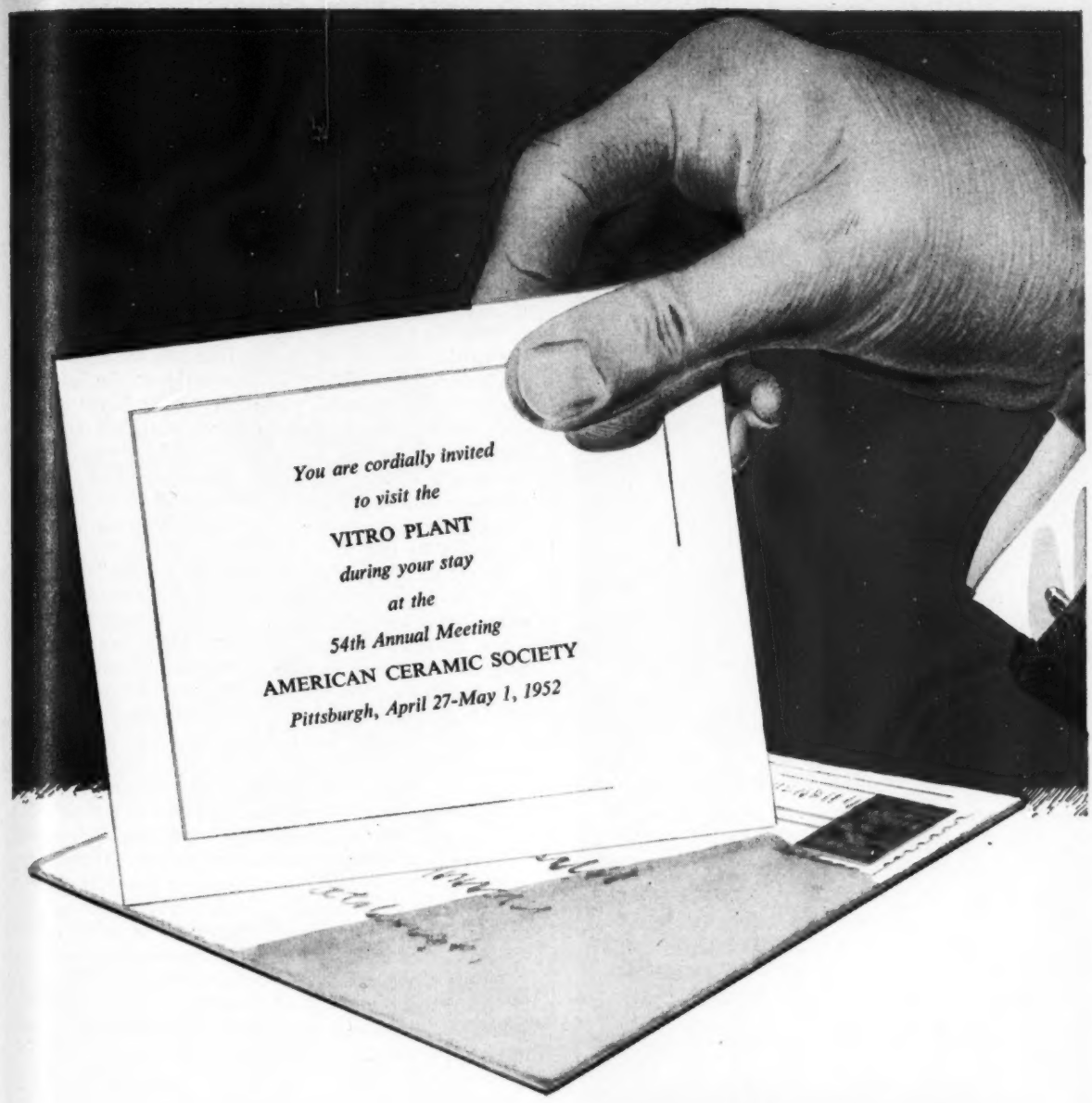
The wage increase was approved on the basis of the tandem relationship to the mold-making employees of the glass container industry who have been granted a 6½¢ increase within the limits approvable under General Wage Regulations 6 and 8, which are the "ten per cent" and cost-of-living regulations.

ANNUAL CONFERENCE ON INDUSTRIAL RESEARCH

Professor David. Bendel Hertz has announced that the Annual Conference on Industrial Research, sponsored by the School of Engineering and the Center for Studies of Research Administration of Columbia University, would consider the problem of Design of Research Operations during the week of June 9 to 13.

The theme of this year's conference includes papers, discussions and clinic sessions on Design of Research Facilities, Design for Communications, Design of Experiments, Design of Projects and Budgets, Design for Research Management and a full day on Design for Operations Research.

In addition to the formal sessions, small discussion groups will be held throughout the week to consider specific problems of the attendees. The proceedings of the conference will be published, with discussion and clinic session material included, as well as the formal papers.



All of us at Vitro are looking forward to seeing you at the 54th Annual Meeting of the American Ceramic Society. While you're in Pittsburgh, we hope you'll accept our invitation to make a tour of our plant. You can be sure we'll be glad to have you.

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THE VITRO MANUFACTURING CO. CORLISS STATION • PITTSBURGH 4, PA.

Sales Representatives: Pittsburgh • Chicago • New York • San Francisco • Toronto

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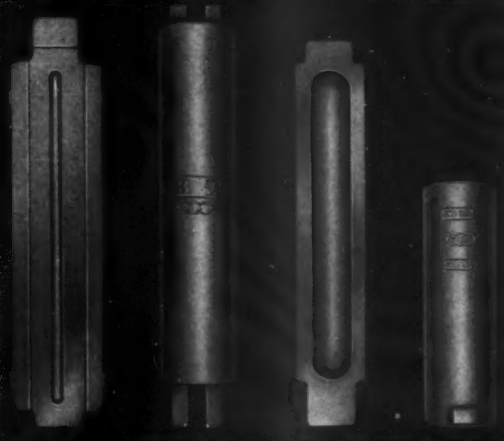
GUNITE

RING STICKS



Ring Sticks are carefully cast to your specifications from your own patterns. Readily machinable.

BAR STOCK

Round bars in standard 14 inch lengths. 1/2 inch diameter to 5 inch diameter by 1/4 inch increments. ALL GUNITE castings are made of Gunite Metal suitably alloyed to provide the ideal glass house material. Gunite Metal is easily machined and readily polished to a mirror finish. Gunite Metal has maximum resistance to heat checking under the severe conditions imposed by glass making operations. You'll get superior service from GUNITE.

PLUNGERS

Standard plungers in all sizes from MG1 to MG10. Easily machined and polished to a mirror finish.

GUNITE FOUNDRIES CORPORATION
ESTABLISHED IN 1854
ROCKFORD GUNITE ILLINOIS

HARDING BATCH PLANT . . .
(*Continued from page* 189)

a lock and key system, along with signal lights and interlocks.

When a car of material arrives on our tracks, the production supervisor secures the number and checks it with the purchasing agent's posting or acknowledgments to ascertain the point of origin and the kind of material shipped in the car. With this information in hand, he selects a key from a board in his office to fit the proper bin for the material in the car and then with the batch unloader visually examines the contents of the car. The unloader then takes the key to the top of the silos and unlocks the bin for the material which is the only lock the particular key will fit. He then sets the spout over the bin opening and when it is properly set, the light for the particular material will show on the board at the unloader's platform. The elevator is energized and can be started from the top only. It can be stopped from above or below. By starting at top only, we feel that the unloader will have to go to the top and check for sure where he may otherwise try to avoid doing so. The top is reached by means of an electric man lift.

Before the material is unloaded, the production supervisor checks each of these steps and signs the batch unloader's report of that car. This report calls for Date, Time, Material, Car number, Unloaded in bin number, Sink and conveyor condition, Proper bin opening unlocked, Spout set in correct bin, Light checking on panel, Visual check of material, Car number checked against material, Unloaded by, Checked by production supervisor, Elevator stopped, Spout removed from bin, Spout area clean, Spout opening locked. There is not supposed to be but one key missing from keyboard at a time.

Our new batch system has been operating for over a year and has been quite satisfactory to date. There were quite a few minor details to work out in the early stages, especially in the interlocking system and automatic operation. Electric eyes are used to control the scale operations and they had to be properly set and adjusted.

Among the many gratifying gains are the uniformity of batch and the improved quality of sheet glass produced. Reducing the human element in batch storing and mixing has been a real asset to date.

CHANCE BROTHERS OPENS NEW FACTORY

Chance Brothers, Ltd. has opened a new factory at Firhill, Glasgow, for the mass production of fluorescent light tubing. While meeting domestic needs, the plant will also provide a substantial surplus for export business.

The £250,000 plant is the result of collaboration between American and British engineers, some features of the plant being adapted from American designs and others designed by the firm's own engineering staff.

Output of the new factory is at the rate of about 3½ miles of tubing per hour. The possibility of running the unit on a 24-hour day basis will be considered when volume of business justifies. At present Thorn Electrical Industries, Ltd. is taking the bulk of the output. There is no other plant producing this type of glass in the United Kingdom.

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INTERNATIONAL POTASH CHEMICALS

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At its mine...at its refinery...at its chemical plant, *International* maintains a constant control over the production of potash salts and the processing of potash chemicals for many industrial purposes.

It's an exclusive *three-way-control* which means greater precision in production all along the line and offers you the advantages of consistent uniformity and deliveries that will fit your schedules.

When you specify *International* potash chemicals, you can be *sure* of quality, of accuracy of specifications and of ample tonnages to satisfy your requirements.

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International MINERALS CHEMICALS potash division

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EXACT WEIGHT Scale checkweighing bottles at the hot end, Lamb Glass Co., Mt. Vernon, Ohio.

Today's Handling and Packaging Problems . . .

The planning stage is the place to cope with labor shortage and cost control this year. How? By skillful use of equipment to cut manpower . . . improve quality . . . cut processing, packaging and handling time. Face the fact of general labor shortage for 1952. Equipment must substitute and since good scales are a vital link in controlling quality, recovering product, insuring uniformity and cutting costs, incorporate them in your plans now. Strive for as many laborless applications as possible. You can do this with EXACT WEIGHT "Selectrol", a fully automatic application for volume high-speed checkweighing. A wide range of EXACT WEIGHT models are available for semi-automatic packaging and handling. If manual operations are necessary, use modern labor saving equipment with these famous weighing units. Remember wherever there's industry there's EXACT WEIGHT scales. You will save time and money by including them in your plans. Write for details.

EXACT WEIGHT Scale Model #88-G. Recommended for checking at the hot end. Has convenient carrying handle. Dial markings by 1/16 oz. graduations or 1 gram metric. Weighs accurately on level or out-of-level benches. Capacity to 3 lbs. or 2000 grams metric.

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Industrial Precision

THE EXACT WEIGHT SCALE COMPANY

952 W. Fifth Ave., Columbus 8, Ohio
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A. C. S. ANNUAL MEETING . . .

(*Continued from page* 190)

Following is a brief review of the seventeen papers on glass technology to be presented in five technical sessions of the Glass Division.

Several papers on the strength of glass will be featured. D. A. Stuart, from Cornell University, and O. L. Anderson, from the University of Utah, collaborated on a paper discussing the factors influencing the strength of glass. The effects of water soaking temperature and certain surface treatments on the strength of glass will be discussed by V. K. Moorthy, F. V. Tooley and G. F. Stockdale of the University of Illinois. Time effects in the fracture of glass will be discussed by Edward Saibel, Carnegie Institute of Technology. W. C. Levengood and E. C. Montgomery, Ohio State University, will discuss thermal shock resistance of sheet glass.

Katherine B. Blodgett, from the General Electric Research Laboratory, a special guest speaker for the Glass Division meeting, will describe a method of developing a conducting surface layer on a silicate glass, such as X-ray shield glass, for grading high potentials.

A study of the infrared reflection of some binary silicate glasses will be presented by I. Simon and H. O. McMahon from Arthur D. Little, Inc., and F. D. Lorey and H. H. Blau from Ohio State University will present data on the development of series of glasses for transmitting near infrared radiation. The second paper in a series on interference films on glass, on the acid-etching of X-ray plate glass, will be presented by Scott Anderson and D. D. Kimpton, from the Anderson Physical Laboratory.

A discussion on glass tank operation and design will be presented by F. L. Bishop from the American Window Glass Company. Phases concerned in the corrosion of alumina-silica refractories by a soda-lime glass will be discussed by C. A. Lambelet and R. B. Sosman, Rutgers University.

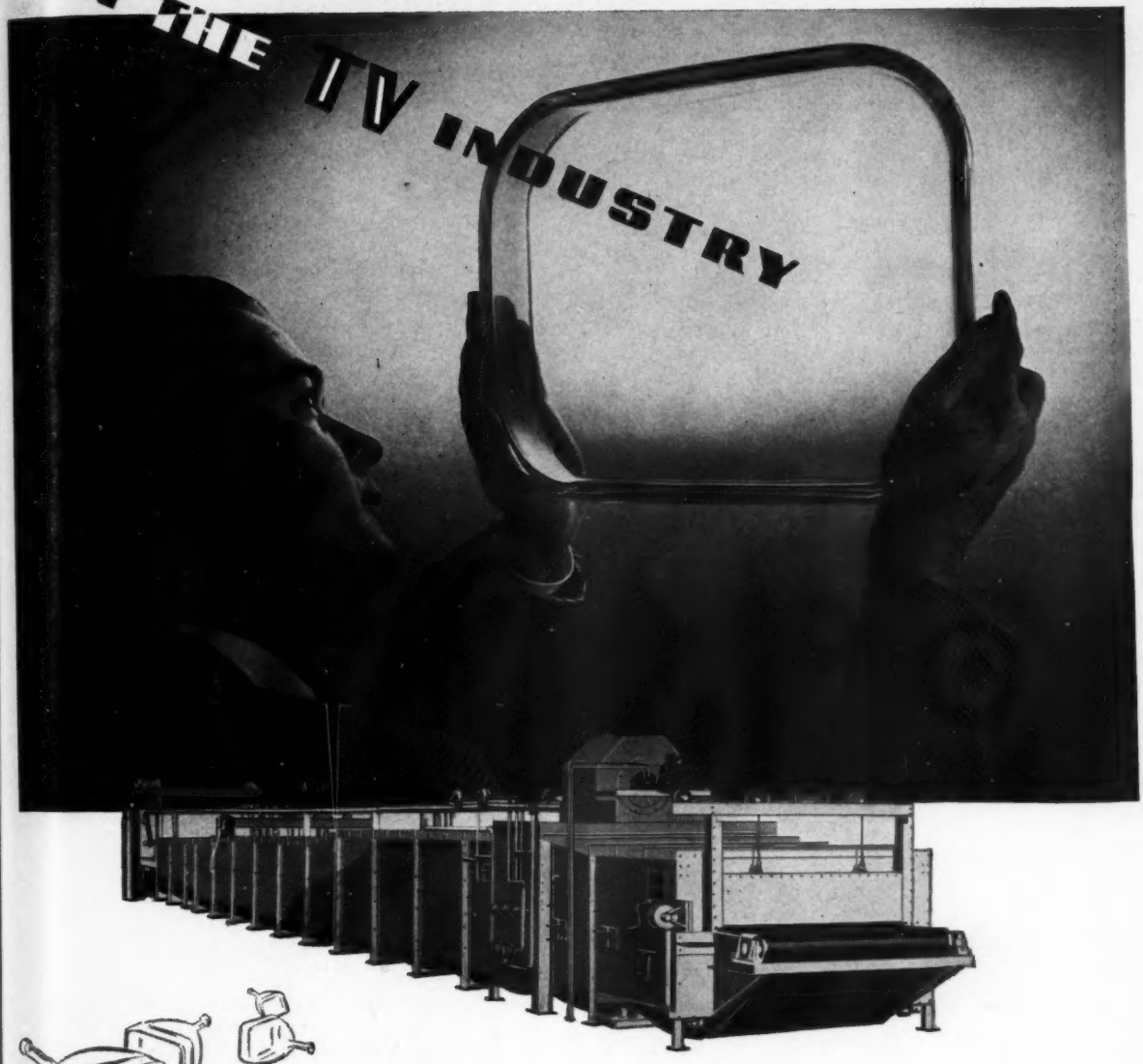
Results of an investigation on the wettability of some Group I and VIII metals by several sodium silicate glasses will be discussed by D. W. Mitchell, V. F. Zackey, S. P. Mitoff and J. A. Pask, from the University of California. O. L. Anderson, from the University of Utah, and D. A. Stuart, Cornell University, again collaborate on a paper on the dependence of ionic conductivity of glasses upon the chemical composition. Equilibrium data on the glass forming region in the BaO-B_2O_3-SiO_2 system will be given by E. H. Hamilton, O. H. Grauer and G. W. Cleek from the National Bureau of Standards. The development of special glasses for the manufacture of X-ray and high-voltage rectifier tubes will be presented by M. J. Zunick and J. B. Gosling, General Electric Company. The surface tension of a series of molten alkali borates was investigated at the National Bureau of Standards and will be reported on by Leo Shartsis and Webster Capps.

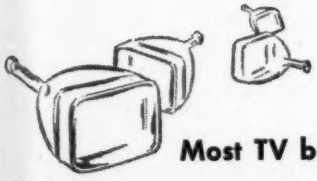
Also scheduled is a discussion on the use of wire strain gauges for determining pressure-strain relationships on television envelopes, by A. Cohen and R. F. Doran, Sylvania Electric Products, Inc.

Trips to plants and research laboratories in the Pittsburgh district which will be taken by Society members on the last day of the meeting have been announced. Members of the plant trip committee are: J. S. Nordyke, Chairman; and Frank Jansma, D. O. Evans, R. W. Limes

(*Continued on page* 216)

IN THE TV INDUSTRY





Most TV bulbs, among the largest and most complex glass units annealed on a production basis, are produced in Surface Combustion lehrs. Here is proof of uniform, exact temperature control. The only lehr with controlled recirculation.

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Surface Combustion CORPORATION
TOLEDO 1, OHIO

A. C. S. ANNUAL MEETING . . .
(*Continued from page* 214)

and R. W. Dally, Committeemen. Trip captains are: C. Burton Clark, R. W. Limes, W. C. Mohr, J. Earle Duncan, F. L. Bishop, J. A. Reising, Harold Ray, C. M. Lampman and A. L. Johnson.

The following plants will be visited: Shenango Pottery Company, Universal-Rundle Corp., Fostoria Glass Company, Radio Corporation of America, Ingram-Richardson Mfg. Company, St. Joseph Lead Company, Alcoa Research Laboratories, Pittsburgh Plate Glass Company, Gulf Research & Development Corp., Westinghouse Electric Corp., Westinghouse Research Laboratories, Jones & Laughlin Steel Corp., Mellon Institute of Industrial Research, Harbison-Walker Refractories Company and United States Steel Company. All trips will be made by charter bus. Each group will visit two locations with time out for lunch. The exact schedule will be available at time of registration.

The annual Ceramic Camera Club salon will be at the William Penn Hotel, and pictures will be on display throughout the meeting.

A Student Speaking Contest, sponsored by the Society, will be divided into two phases. The first will be on Sunday afternoon when all speakers will compete. In the evening, finalists will address the entire meeting audiences. Money and membership in The American Ceramic Society are the prizes.

School dinners will be Monday evening April 28, and, as is the usual custom, will be arranged for individually by the various schools. These dinners are usually arranged to be held in restaurants outside the meeting hotel.

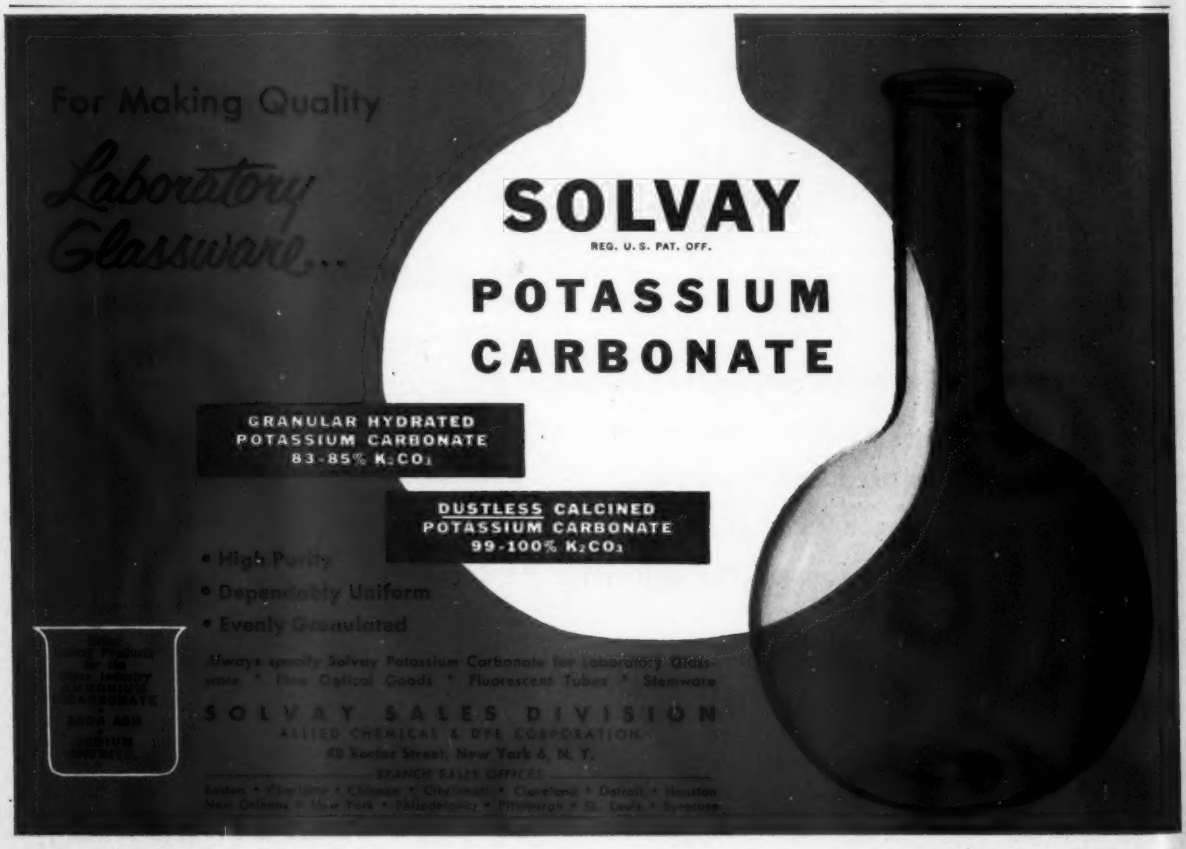
Howard Lanin, noted eastern producer, who arranged annual meeting shows in 1947 and 1950, will again book talent for the entertainment committee. Mrs. D. Owen Evans, Charleroi, Pa., is General Chairman of the Women's activities. Assisted by ten chairmen and their committees, she has arranged for a program consisting of plant trips, teas, tours, style show, TV program, and places to eat and visit in and around Pittsburgh for the women attending the convention.

Members of her chairmen committee and their assignments are: Mrs. L. Roger Burks, prizes; Mrs. Earl Frazier, card party; Mrs. Theodore Lenchner, brunch and style show; Mrs. Robert W. Limes, sightseeing tours; Mrs. Edward E. Marbaker, hotel tours; Mrs. J. S. Nordyke, transportation and Heinz trip; Mrs. Robert R. Robinson, headquarters; Mrs. Andrew C. Wagner, television show; Mrs. Ralph L. Weaton, publicity; and Mrs. George G. Weddell, photographs.

A. P. GREEN APPOINTS DISTRICT MANAGER

The A. P. Green Fire Brick Company has announced the appointment of James W. Minter as District Sales Manager of its new Birmingham, Alabama office.

Mr. Minter has been connected with the firm since 1941. During that time, he has served in various phases of its operation, primarily sales. Prior to his present appointment, he was in charge of sales at the company's Chattanooga office. Before joining the Green company, he attended the University of Missouri.



Quality Production Builds a Plant...

New Hommel Warehouse, Laboratory and Office in Los Angeles, California

Ernest M. Hommel
President

A remembrance plaque of Oscar Hommel, founder

WELCOME TO PITTSBURGH!

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The O. Hommel Company has developed many new, beautiful pastels, and brilliant colors. . . . Ask to see them.

Glass Colors—for Spraying, Brushing and Squeegee, either Hot or Cold.

Sulphite Resisting—for Lighting Fixtures and Refrigeration.

Acid Resisting—for table and laboratory glass ware.

Alkali Resisting—for tableware, beverage and milk bottles.

Ices—a permanent crystalline finish of sparkling beauty.

Gold—Liquid Bright Gold, Powder Gold, Paste Burnish Gold, Liquid Burnish Gold, Liquid Bright Platinum.

Lustre—Pearl, Yellow, Blue, Green, Cranberry, Ruby, Orange.

Squeegee Oil—Hommel Squeegee Oil—The standard for 30 years. Printing on manual or automatic machines. Hot or cold.

Squeegee Paste—for hot printing.

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AGITATORS, ALCOHOLS, ALUMINUM, ANTIMONY, BALL MILLS, BORAX, BORIC ACID, BRAZETTE (Bronzing Powder), BRONZE POWDERS, BRUSHES (Decorating), CADMIUM (Oxide, Sulphate, Sulphide, Carbonate), COBALT, COPPER, DECORATING SUPPLIES

FELDSPAR, FLINT, FLINT PEBBLES, FLUORSPAR (Metallurgical, Ceramic, Ground), FROSTING PASTE ("Snow Flake"), FURNACES (Decorating, Enamel), KILNS (Decorating), LEAD, LITHIUM SALTS, MAGNESIUM CARBONATE, NEUTRALTONE, OILS (All Types), PALLADIUM (Liquid Bright)

PORCELAIN BALLS, PORCELAIN BRICKS, PORCELAIN JARS, PORCELANITE, POWDERED METALS, RARE METALS, SPRAY BOOTHS, SPRAYING MACHINES (Continuous, Guns, Jars), STILTS, TALC (All grades), TANKS, WHITING (All grades), ZIRCONIUM SILICATE (All grades and meshes)

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A Marietta concrete storage system is the efficient, economical way to increase your "per-day" storage capacity. Marietta tanks permit you to buy and store bulk materials in large quantity to take advantage of favorable prices, meet unexpected shortages.

Tanks are constructed of Air-Cell or solid concrete staves, can be erected in any size, any arrangement, in a matter of weeks, to give you permanent, fully protected storage for coal, coke, sand, gravel, dry chemicals . . . any bulk material that requires safe, low-cost storage.

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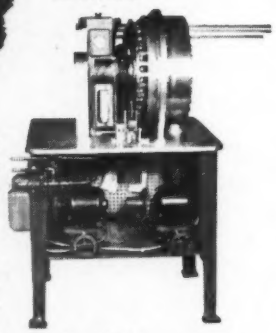
KAHLE specialists in custom built glass-making machinery

#1507
HIGH SPEED AUTOMATIC GLASS TUBING CUTTING MACHINE



High production on specific diameters. 30 head, continuous drive. Variable speeds. Length of cut adjustable. 7500-15,000 pieces per hour.

All Kahle equipment is custom-made — we don't turn out *stock* machinery. That's why we can do a better job for you — all our engineering skill and experience is concentrated on your specific glass manufacturing or finishing problem.

We're Specialists in equipment that cuts costs, increases production, assures uniformity in the manufacture of: ampules • cathode ray tubes • standard, miniature, sub-miniature radio tubes • sub-miniature tubes • fluorescent lamps • incandescent lamps • photocells • x-ray tubes • glass products.

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Kahle ENGINEERING COMPANY
1308 Seventh Street
North Bergen, New Jersey, U. S. A.

QUALITY CONTROL . . .
(*Continued from page* 192)

control chart had not been kept on the glazing machine, this loss of 82 pieces, or over 25 per cent, would probably have been absorbed in the total percentage of loss for the day and this defective mold would have gone undetected for days and possibly weeks. This is one example of the many changes for the better that have come about through quality control.

In introducing a technique such as quality control, many people affected by its introduction are exceptionally skeptical. Some fear their authority is being jeopardized, and others will agree to go along but actually try to hinder its success. This is not always the case, but it has been known to have happened in some manufacturing plants. It is, therefore, very important to aim at an improvement that is likely to be easily recognized by everyone concerned. I cannot say that quality control is the answer to all the problems in a hand plant, but from my experience I have found it a big help toward producing a quality product more economically.

In summarizing this paper, the advantages derived from quality control are as follows:

(1) Reduction in shop losses.

(2) Lower percentage of breakage during annealing.

(3) Lower percentage of loss in finishing.

(4) Improvement of manufacturing methods and equipment.

(5) Improvement in quality.

(6) Reduction in manufacturing cost.

If hand plants are to survive in this country today, every step toward economy and quality that is at all possible should be taken. I feel that quality control is one such step in the right direction.

KOREAN GLASS FACTORY . . .
(*Continued from page* 193)

was crushed and reused in the charge, eliminating waste from these rejections.

Prior to the invasion by the U.S. Marines last September, the owner has possessed over 100 different molds and designs, but when he cleared away the wreckage of the pre-invasion bombardment only twelve of these remained. Though three of his charging furnaces were destroyed, the old man seemed confident that he could rebuild his business because, as he determinedly told our interpreter, "I know my business. My father blew glass before me and his father before him." When asked if he was going to apply for help with ECA or other agencies he didn't understand what we meant but pointed to his brain, gestured proudly at his family about him and said smilingly, "I do not need any help. I only want the war to end!"

• A minor fire struck the offices and laboratory of The O. Hommel Company plant at Carnegie, Pa., during the early hours of February 13. The gas and electric connections to the plant were cut for eight hours after which the plant was back on its regular production schedule. The offices and laboratory facilities were inconvenienced for a few days while new quarters were set up.

In dependable hands

If calcined or hydrated aluminas are important to your product's quality, you'll be in dependable hands when you order from Kaiser Chemicals.

You'll be assured of dependable supply of the quantities needed because Kaiser Chemicals is now vastly expanding its alumina production facilities.

You'll be assured of quality that's uniformly pure . . . quality that for years has met the rigid requirements of manufacturers of abrasives, glass, ceramics, refractories, catalysts, chemicals for water treatment.

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CALL US TODAY. We'll be on the job the minute you say the word. Principal sales offices: *Chemical Division*, Kaiser Aluminum and Chemical Sales, Inc., 1924 Broadway, Oakland, California. First National Tower, Akron, Ohio.

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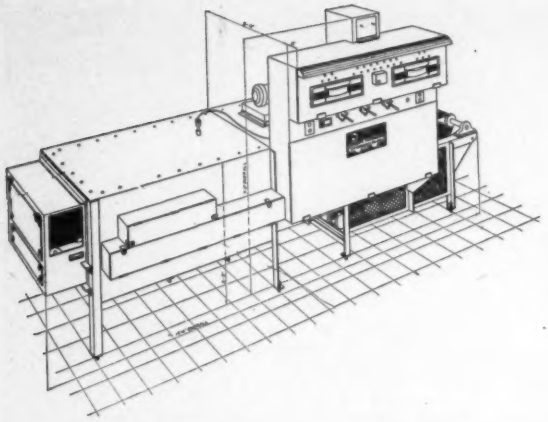
calcined and hydrated aluminas

Alumina • Basic Refractory Bricks and Ramming Materials • Dolomite • Magnesia • Magnesite • Periclase



● Above illustration shows a special electric oven for the annealing of light ware as required for the electronic field.

Our knowledge of glass factory problems is your assurance of first quality glass melting and manufacturing equipment, as well as top service and performance.

We shall be pleased to consult with you concerning your manufacturing problems.

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RESEARCH DIGEST . . .
(*Continued from page* 199)

where D = diameter of circule inscribed in the outer octagon.

5. Value for a prismatic bottle of rectangular section.

$$dm = \frac{1}{2}\left(\frac{A+B}{2} - \sqrt{\frac{A-B}{4}}^{2} + \frac{v}{h}\right),$$

where A = external length of section; B = external width of section.

6. Value for a truncated, cone-shaped bottle.

$$dm = \frac{h}{M}\left(\frac{R+r}{2} - \sqrt{\frac{0.3183r}{h} - 0.0833\ (R-r)}\right),$$

where h = perpendicular height; M = slant height; R = maximum external diameter; r = minimum external diameter.

7. Value for a bottle of truncated pyramid shape and square section.

$$dm = \frac{h}{M}\left(\frac{a+b}{4} - \frac{1}{2}\sqrt{\frac{v}{h} - 0.0833\ (a-b)}\right),$$

where h = perpendicular height; M = slant height; a = side of maximum square section; b = side of minimum square section.

8. Value for a bottle of elliptical section.

$$dm = \frac{1}{2}\left(\frac{A^1+B^1}{2} - \sqrt{0.0625\ (A^1-B^1) + \frac{0.3183v}{h}}\right),$$

where A^1 = major axis of external ellipse; B^1 = minor axis of external ellipse.

The results obtained by the use of the above formulae

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were checked by between 30 and 60 direct measurements of the wall thicknesses. These mean values were found to be in good agreement with the calculated results.

A. C. S. SECTION ACTIVITIES

E. B. Shand, of the research department of Corning Glass Works, addressed the Northwestern Ohio Section of the American Ceramic Society at its March meeting. His topic was "Glass as a Dielectric Material." W. Edward Cramer, President-Elect of the American Ceramic Society, was a guest and spoke briefly on the organization of the Society.

Approximately 130 members and guests of the Tennessee Valley Section of the A. C. S. met for a two-day meeting during March, where the brick, clay and tile companies were hosts. Included in the program were a technical session, open house, banquet and plant trip. The next meeting of the Section is scheduled for July 17 and 18.

The Tennessee Valley Section held its first meeting in Macon, Georgia. This, too, was a two-day meeting and included a technical program, open house, banquet, plant trips and a barbecue. Announcement was made of coming meetings, the Summer meeting to be held in Clemson, South Carolina, and the Fall meeting to be held in Chattanooga, Tenn.

• At a recent meeting held in Baltimore, Maryland, Albert Kellner, Export Manager of the Pemco Corporation, was elected President of the Baltimore Foreign Trade Forum for 1952.

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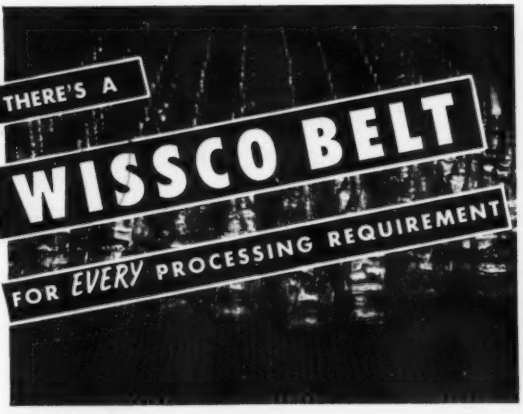

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